

Illinois-American Water Company  
Correction of ICC Staff Witness Freely's DCF Analysis  
To Reflect Elimination of Companies with Negative Projected Growth in Earnings

	Column Number								
	1	2	3	4	5	6	7	8	9
	Next Four Dividends (1)				Next Annual Dividend (2)	Price on February 1, 2012 (3)	Dividend Yield (4)	Projected EPS Growth (5)	Indicated DCF Result (6)
ICC Witness Freely's Water Sample Group	D <sub>1,1</sub>	D <sub>1,2</sub>	D <sub>1,3</sub>	D <sub>1,4</sub>	(2)				
American States Water	\$ 0.280	\$ 0.307	\$ 0.307	\$ 0.307	\$ 1.202	\$ 36.87	3.26%	9.79%	13.05%
Aqua America	0.165	0.165	0.165	0.178	0.673	22.31	3.02%	8.08%	11.10%
Artesian Resources	0.193	0.199	0.199	0.203	0.794	19.29	4.12%	4.93%	9.05%
California Water Service	0.158	0.158	0.158	0.158	0.630	18.90	3.33%	9.90%	13.23%
Connecticut Water Service	0.238	0.238	0.251	0.251	0.977	32.03	3.05%	5.70%	8.75%
Middlesex Water Company	0.185	0.185	0.185	0.183	0.738	19.18	3.85%	-1.15%	NA (7)
York Water	0.134	0.134	0.134	0.141	0.542	17.95	3.02%	5.63%	8.65%
									10.64%

## Notes:

- (1) From ICC Staff Exhibit 6.0, Schedule 6.7.
- (2) Sum of Columns 1 through 4.
- (3) From ICC Staff Exhibit 6.0, Schedule 6.6.
- (4) Column 5 / Column 6.
- (5) Stage 1 growth from ICC Staff Exhibit 6.0, Schedule 6.5.
- (6) Column 7 + Column 8.
- (7) Not applicable due to negative projected growth in EPS.

# **Illinois American Water Company**

## Correction of ICC Staff Witness Freetly's Risk Premium Analysis (CAPM / ECAPM)

### **Risk Premium (CAPM) Cost of Equity Estimate**

<u>Proxy Group</u>	<u>Risk-Free Rate (1)</u>		<u>Beta</u>		<u>Risk Premium</u>	<u>Cost of Common Equity</u>
Water Group	3.42%	+	0.61	x	(13.18% - 3.42%)	9.37%

### **Risk Premium (ECAPM) Cost of Equity Estimate**

<u>Proxy Group</u>	<u>Risk-Free</u>		<u>Beta</u>		<u>Risk Premium</u>	<u>Cost of Common Equity</u>
Water Group	3.42%	+	0.61	x	(13.18% - 3.42%)	10.33%

Average CAPM / ECAPM Result for Water Group: 9.85%

Notes: (1) Average forecast based upon six quarterly estimates of 30-year U.S. Treasury Bonds (notes) per the consensus of nearly 50 economists reported in Blue Chip Financial Forecasts dated March 1, 2012 (from page 18 of IAWC Exhibit 10.21R). The estimates are detailed below.

	<u>Projected 30 Year Treasury Bond</u>
First Quarter 2012	3.10%
Second Quarter 2012	3.20%
Third Quarter 2012	3.30%
Fourth Quarter 2012	3.50%
First Quarter 2013	3.60%
Second Quarter 2013	3.80%
Average	<u><u>3.42%</u></u>

Capital Structure Based upon Total Capital for the  
ICC Staff Witness Freetly's Water Proxy Group  
2006 - 2010, Inclusive

	<u>2010</u>	<u>2009</u>	<u>2008</u>	<u>2007</u>	<u>2006</u>	<u>5 YEAR AVERAGE</u>
<u>American States Water Co.</u>						
Long-Term Debt	40.64 %	45.78 %	40.95 %	44.11 %	45.95 %	43.49 %
Short-Term Debt	8.24	2.50	11.45	6.13	5.48	6.76
Preferred Stock	0.00	0.00	0.00	0.00	0.00	0.00
Common Equity	51.12	51.72	47.60	49.76	48.57	49.75
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>
<u>Aqua America, Inc.</u>						
Long-Term Debt	55.24 %	55.99 %	52.39 %	54.48 %	48.53 %	53.33 %
Short-Term Debt	3.17	1.06	3.36	2.50	5.88	3.19
Preferred Stock	0.02	0.02	0.09	0.09	0.09	0.06
Common Equity	41.57	42.93	44.16	42.93	45.50	43.42
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>
<u>Artesian Resources Corp.</u>						
Long-Term Debt	46.04 %	47.83 %	54.48 %	51.94 %	59.00 %	51.86 %
Short-Term Debt	12.87	11.63	8.54	0.50	4.65	7.64
Preferred Stock	0.00	0.00	0.00	0.00	0.00	0.00
Common Equity	41.09	40.54	36.98	47.56	36.35	40.50
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>
<u>California Water Service Group</u>						
Long-Term Debt	51.19 %	47.23 %	39.59 %	42.86 %	43.47 %	44.87 %
Short-Term Debt	2.52	1.46	5.46	0.00	0.00	1.89
Preferred Stock	0.00	0.00	0.00	0.51	0.51	0.20
Common Equity	46.29	51.31	54.95	56.63	56.02	53.04
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>
<u>Connecticut Water Service, Inc.</u>						
Long-Term Debt	44.18 %	45.46 %	44.23 %	46.22 %	43.12 %	44.64 %
Short-Term Debt	10.42	10.15	5.79	3.23	2.93	6.50
Preferred Stock	0.31	0.31	0.37	0.42	0.47	0.38
Common Equity	45.09	44.08	49.61	50.13	53.48	48.48
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>
<u>Middlesex Water Company</u>						
Long-Term Debt	41.66 %	40.90 %	44.91 %	48.37 %	48.33 %	44.83 %
Short-Term Debt	5.12	13.63	8.53	2.25	0.92	6.09
Preferred Stock	1.01	1.07	1.11	1.43	2.93	1.51
Common Equity	52.21	44.40	45.45	47.95	47.82	47.57
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>
<u>York Water Company</u>						
Long-Term Debt	48.28 %	45.77 %	53.27 %	50.08 %	48.82 %	49.24 %
Short-Term Debt	0.00	2.95	3.70	2.13	0.00	1.76
Preferred Stock	0.00	0.00	0.00	0.00	0.00	0.00
Common Equity	51.72	51.28	43.03	47.79	51.18	49.00
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>
<u>ICC Staff Witness Freetly's Water Proxy Group</u>						
Long-Term Debt	46.75 %	46.99 %	47.12 %	48.29 %	48.17 %	47.46 %
Short-Term Debt	6.05	6.20	6.69	2.39	2.84	4.83
Preferred Stock	0.19	0.20	0.22	0.35	0.57	0.31
Common Equity	47.01	46.61	45.97	48.97	48.42	47.40
Total Capital	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>	<u>100.00 %</u>

Source of Information

EDGAR Online's I-Metrix Database

Annual Forms 10-K



# Decoupling: Impact on the Risk of Public Utility Stocks

Richard A. Michelfelder, Ph. D.  
Clinical Associate Professor of Finance  
Rutgers University  
School of Business – Camden

Managing Consultant  
AUS Consultants

Society of Utility Regulatory and Financial Analysts  
April 15 , 2011

# Today's Discussion

- Introduction
- Impact of Decoupling on Risk
- Two Empirical Tests:
  - The Predictive Risk Premium Model™
  - Differences in Systematic Risk
- Conclusion

(Benefitted by input from Pauline Ahern, Frank Hanley, Dylan DAscendis, and Selby Jones III of AUS Consultants. )



# Introduction

- Ratemaking mechanisms that decouple revenues from commodity sales volume sweeping the US.
- Started in CA in early 80's to take away disincentive to promoting energy end-use efficiency.
- Currently being implemented for gas utilities and the call for water utilities (outside CA and NY) started at NARUC Water Committee meeting in February 2011
- Reduces risk – is it enough to decrease the cost of capital?

# Decoupling Reduces Volatility of Cash Flow

$$\text{Operating CF (OCF)} = \text{Revenues}(R) - \text{Cost}(C)$$

Volatility of OCF is the variance of OCF:

$$\text{Var}(R - C) = \text{Var}(R) + \text{Var}(C) + \text{Cov}(R, C)$$

# Decoupling Reduces Volatility of Cash Flow

$$Var(R - C) = Var(R) + Var(C) + Cov(R, C)$$

With Decoupling, Volatility is Lower:

$$Var(R - C) = Var(C)$$

# Decoupling Lowers Systematic Risk

Systematic risk is defined as:

$$\beta_i = \rho_{i,m} \frac{\sigma_i}{\sigma_m}$$

where  $\rho_{i,m}$ : the correlation coefficient of the individual stock ( $i$ ) and market ( $m$ ) return, and,

$\sigma_i$  and  $\sigma_m$ : standard deviation of the individual stock and market returns respectively.

# Decoupling Lowers Systematic Risk

Defining variables with superscript ‘D,’ with decoupling,

$\sigma_i^D$  and  $\rho_{i,m}^D$  are lower therefore systematic risk is lower with decoupling and defined as:

$$\beta_i^D = \rho_{i,m}^D \frac{\sigma_i^D}{\sigma_m}$$

Therefore,  $\beta_i^D = \rho_{i,m}^D \frac{\sigma_i^D}{\sigma_m}$  is less than  $\beta_i = \rho_{i,m} \frac{\sigma_i}{\sigma_m}$

# Predictive Risk Premium Model™

- Model generalized by Michelfelder and Pilotte (2011) under second review at the *Journal of Economics and Business*.
- Public utility application to common equity cost of capital analysis in Ahern, Hanley, and Michelfelder (2011) under second review at the *Journal of Regulatory Economics*.
- Exhaustive public utility applications study planned.

3/5/2012



# The Predictive Risk Premium Model™

Predictive Risk Premium Model has two stages:

- 1) Predicted equity risk premium depends upon predicted volatility
- 2) Predicted volatility depends on:
  - previous volatility
  - previous prediction error

# The Predictive Risk Premium Model™

Technically:

$$\text{Predicted RP} = a (\text{Predicted } \sigma^2)$$

$$\text{Predicted } \sigma^2 = b_0 + b_1 (\text{Previous } \sigma^2) + b_2 (\text{Previous Prediction Error})^2$$

where  $a$ ,  $b_1$ ,  $b_2$  are slopes and  $b_0$  is a constant

# Test for Change in Risk Premium After Decoupling

$$\text{Predicted RP} = a (\text{Predicted } \sigma^2) + D_{rp} (\text{decoupling})$$

$$\text{Predicted } \sigma^2 = b_0 + b_1 (\text{Previous } \sigma^2) + b_2 (\text{Previous Prediction Error})^2$$

where  $a$ ,  $b_1$ ,  $b_2$  are slopes and  $b_0$  is a constant

*$D_{rp}$  is the change in the predicted RP after decoupling*

# Test for Change in Volatility of Risk Premium after Decoupling

Predicted RP =  $a$  (Predicted  $\sigma^2$ )

Predicted  $\sigma^2 = b_0 + b_1$  (Previous  $\sigma^2$ ) +  $b_2$  (Previous Prediction Error)<sup>2</sup> +  $D_v$  (*decoupling*)

where  $a$ ,  $b_1$ ,  $b_2$  are slopes and  $b_0$  is a constant

*$D_v$  is the change in volatility in risk premium after decoupling*

# Differences in Systematic Risk

Differences in the means of annual betas  
before and after implementation of  
decoupling

# Data and Sample

PRPM™ Data: Monthly holding period returns minus Ibbotson yield on US Long Treasury Bonds for PRPM

Beta Data: U. Chicago's Center for Research in Regulated Industries (known as "CRSP") yearly betas for beta difference

Public utilities sample: all electric, electric and gas, gas, and water company stocks where 95%+ of revenues decoupled

# Companies

<u>Company</u>	<u>Eff. Decoupling Date</u>	<u>Beginning of Measurement Period</u>	<u>Total # of Months</u>
ED	10/31/07	07/30/04	78
LG	11/29/02	09/30/04	196
PCG	01/31/83	01/31/55	672
EIX	01/31/83	01/31/55	672
CWT	07/31/08	01/31/06	60
CHG	07/31/09	07/31/06	54
CMS	05/28/10	05/31/07	44
SJI	01/29/93	01/31/75	432
DGAS	01/31/00	01/31/89	264
HE	12/31/10	12/31/07	37
NJR	01/31/94	01/31/77	408
AWR	11/28/08	05/30/04	82
POR	12/31/10	12/31/07	38
IDA	03/30/07	05/30/03	92



# Results of PRPMTM Decoupling Tests

No differences in expected risk premium

No differences in expected volatility of risk premium

# Results of Differences in Systematic Risk

- Mean pre-decoupling beta: 0.67
- Mean post-decoupling beta: 0.59
- Although lower, difference not statistically significant
- 7 of 11 mean pre/post beta differences for individual companies not statistically significant
  - Of those significant 3 are higher and 1 is lower

Conclusion: No differences in systematic risk

# Conclusions

- Theoretically and practically, decoupling reduces investment risk of public utility stocks.
- The impact of decoupling on stock returns, risk, and cost of capital cannot be isolated nor measured (to date) due to the myriad of other risk drivers impacting the investment risk of stocks.
- Utility executives have revealed their preference for decoupling, which says more about the impact of decoupling on risk and cost of capital than theoretical or empirical tests.

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**Chapter 5****The Equity Risk Premium**

The expected equity risk premium can be defined as the additional return an investor expects to receive to compensate for the additional risk associated with investing in equities as opposed to investing in riskless assets. It is an essential component in several cost of equity estimation models, including the buildup method, the capital asset pricing model (CAPM), and the Fama-French three factor model. It is important to note that the expected equity risk premium, as it is used in discount rates and cost of capital analysis, is a forward-looking concept. That is, the equity risk premium that is used in the discount rate should be reflective of what investors think the risk premium will be going forward.

Unfortunately, the expected equity risk premium is unobservable in the market and therefore must be estimated. Typically, this estimation is arrived at through the use of historical data. The historical equity risk premium can be calculated by subtracting the long-term average of the income return on the riskless asset (Treasuries) from the long-term average stock market return (measured over the same period as that of the riskless asset). In using a historical measure of the equity risk premium, one assumes that what has happened in the past is representative of what might be expected in the future. In other words, the assumption one makes when using historical data to measure the expected equity risk premium is that the relationship between the returns of the risky asset (equities) and the riskless asset (Treasuries) is stable. The stability of this relationship will be examined later in this chapter.

Since the expected equity risk premium must be estimated, there is much controversy regarding how the estimation should be conducted. A variety of different approaches to calculating the equity risk premium have been utilized over the years. Such studies can be categorized into four groups based on the approaches they have taken. The first group of studies tries to derive the equity risk premium from historical returns between stocks and bonds as was mentioned above. The second group, embracing a supply side model,

uses fundamental information such as earnings, dividends, or overall economic productivity to measure the expected equity risk premium. A third group adopts demand side models that derive the expected returns of equities through the payoff demanded by investors for bearing the risk of equity investments.<sup>1</sup> The opinions of financial professionals through broad surveys are relied upon by the fourth and final group.

The range of equity risk premium estimates used in practice is surprisingly large. Using a low equity risk premium estimate as opposed to a high estimate can have a significant impact on the estimated value of a stream of cash flows. This chapter addresses many of the controversies surrounding estimation of the equity risk premium and focuses primarily on the historical calculation but also discusses the supply side model.

**Calculating the Historical Equity Risk Premium**

In measuring the historical equity risk premium one must make a number of decisions that can impact the resulting figure; some decisions have a greater impact than others. These decisions include selecting the stock market benchmark, the risk-free asset, either an arithmetic or a geometric average, and the time period for measurement. Each of these factors has an impact on the resulting equity risk premium estimate.

**The Stock Market Benchmark**

The stock market benchmark chosen should be a broad index that reflects the behavior of the market as a whole. Two examples of commonly used indexes are the S&P 500® and the New York Stock Exchange Composite Index. Although the Dow Jones Industrial Average is a popular index, it would be inappropriate for calculating the equity risk premium because it is too narrow.

We use the total return of our large company stock index (currently represented by the S&P 500) as our market benchmark when calculating the equity risk premium. The S&P 500 was selected as the appropriate market benchmark because it is representative of a large sample of companies across a large number of industries. As of December 31, 1993, 88 separate industry groups were included in the index, and the industry composition of the index has not changed since. The S&P 500 is also one of

the most widely accepted market benchmarks. In short, the S&P 500 is a good measure of the equity market as a whole. Table 5-1 illustrates the equity risk premium calculation using several different market indices and the income return on three government bonds of different horizons.

**Table 5-1:** Equity Risk Premium with Different Market Indices

	Equity Risk Premia		
	Long-Horizon (%)	Intermediate-Horizon (%)	Short-Horizon (%)
S&P 500	6.72	7.22	8.22
Total Value-Weighted NYSE	6.52	7.03	8.02
NYSE Deciles 1–2	5.99	6.50	7.49

Data from 1926–2010.

The equity risk premium is calculated by subtracting the arithmetic mean of the government bond income return from the arithmetic mean of the stock market total return. Table 5-2 demonstrates this calculation for the long-horizon equity risk premium.

**Table 5-2:** Long-Horizon Equity Risk Premium Calculation

Long-Horizon	Arithmetic Mean			Equity Risk Premium (%)
	Market Total Return (%)	Risk-Free Rate (%)		
S&P 500	11.88	— 5.17	=	6.72*
Total Value-Weighted NYSE	11.69	— 5.17	=	6.52
NYSE Deciles 1–2	11.15	— 5.17	=	5.99*

Data from 1926–2010. \*difference due to rounding.

Data for the New York Stock Exchange is obtained from Morningstar and the Center for Research in Security Prices (CRSP) at the University of Chicago's Graduate School of Business. The "Total" series is a capitalization-weighted index and includes all stocks traded on the New York Stock Exchange except closed-end mutual funds, real estate investment trusts, foreign stocks, and Americus Trusts. Capitalization-weighted means that the weight of each stock in the index, for a given month, is proportionate to its market capitalization (price times number of shares outstanding) at the beginning of that month. The "Decile 1–2" series includes all stocks with capitalizations that rank within the upper 20 percent of companies traded on the New York Stock Exchange, and it is therefore a large-capitalization index. For more information on the Center for Research in Security Pricing data methodology, see Chapter 7.

The resulting equity risk premia vary somewhat depending on the market index chosen. It is expected that using the "Total" series will result in a higher equity risk premium than using the "Decile 1–2" series, since the "Decile 1–2" series is a large-capitalization series. As of September 30, 2010, deciles 1–2 of the New York Stock Exchange contained the largest 274 companies traded on the exchange. The "Total" series includes smaller companies that have had historically higher returns, resulting in a higher equity risk premium.

The higher equity risk premium arrived at by using the S&P 500 as a market benchmark is more difficult to explain. One possible explanation is that the S&P 500 is not restricted to the largest 500 companies; other considerations such as industry composition are taken into account when determining if a company should be included in the index. Some smaller stocks are thus included, which may result in the higher equity risk premium of the index. Another possible explanation would be what is termed the "S&P inclusion effect." It is thought that simply being included among the stocks listed on the S&P 500 augments a company's returns. This is due to the large quantity of institutional funds that flow into companies that are listed in the index.

Comparing the S&P 500 total returns to those of another large-capitalization stock index may help evaluate the potential impact of the "S&P inclusion effect." Prior to March 1957, the S&P index that is used throughout this publication consisted of 90 of the largest stocks. The index composition was then changed to include 500 large-capitalization stocks that, as stated earlier, are not necessarily the 500 largest. Deciles 1–2 of the NYSE contained just over 200 of the largest companies, ranked by market capitalization, in March of 1957. The number of companies included in the deciles of the NYSE fluctuates from quarter to quarter, and by September of 2010, deciles 1–2 contained 274 companies. Though one cannot draw a causal relationship between the change in construction and the correlation of these two indices, this analysis does indicate that the "S&P inclusion effect" does not appear to be very significant in recent periods.

Another possible explanation could be differences in how survivorship is treated when calculating returns. The Center for Research in Security Prices includes the return for a company in the average decile return for the period following the company's removal from the decile,

whether caused by a shift to a different decile portfolio, bankruptcy, or other such reason. On the other hand, the S&P 500 does not make this adjustment. Once a company is no longer included among the S&P 500, its return is dropped from the index. However, this effect may be lessened by the advance announcement of companies being dropped from or added to the S&P 500. In many instances throughout this publication we will present equity risk premia using both the S&P 500 and the NYSE "Deciles 1–2" portfolio to provide a comparison between these large-capitalization benchmarks.

#### **The Market Benchmark and Firm Size**

Although not restricted to include only the 500 largest companies, the S&P 500 is considered a large company index. The returns of the S&P 500 are capitalization weighted, which means that the weight of each stock in the index, for a given month, is proportionate to its market capitalization (price times number of shares outstanding) at the beginning of that month. The larger companies in the index therefore receive the majority of the weight. The use of the NYSE "Deciles 1–2" series results in an even purer large company index. Yet many valuation professionals are faced with valuing small companies, which historically have had different risk and return characteristics than large companies. If using a large stock index to calculate the equity risk premium, an adjustment is usually needed to account for the different risk and return characteristics of small stocks. This will be discussed further in Chapter 7 on the size premium.

#### **The Risk-Free Asset**

The equity risk premium can be calculated for a variety of time horizons when given the choice of risk-free asset to be used in the calculation. The *2011 Ibbotson® Stocks, Bonds, Bills, and Inflation® Classic Yearbook* provides equity risk premia calculations for short-, intermediate-, and long-term horizons. The short-, intermediate-, and long-horizon equity risk premia are calculated using the income return from a 30-day Treasury bill, a 5-year Treasury bond, and a 20-year Treasury bond, respectively.

Although the equity risk premia of several horizons are available, the long-horizon equity risk premium is preferable for use in most business-valuation settings, even if an investor has a shorter time horizon. Companies are entities that generally have no defined life span; when determining a company's value, it is important to use a

long-term discount rate because the life of the company is assumed to be infinite. For this reason, it is appropriate in most cases to use the long-horizon equity risk premium for business valuation.

#### **20-Year versus 30-Year Treasuries**

Our methodology for estimating the long-horizon equity risk premium makes use of the income return on a 20-year Treasury bond; however, the Treasury currently does not issue a 20-year bond. The 30-year bond that the Treasury recently began issuing again is theoretically more correct due to the long-term nature of business valuation, yet Ibbotson Associates instead creates a series of returns using bonds on the market with approximately 20 years to maturity. The reason for the use of a 20-year maturity bond is that 30-year Treasury securities have only been issued over the relatively recent past, starting in February of 1977, and were not issued at all through the early 2000s.

The same reason exists for why we do not use the 10-year Treasury bond—a long history of market data is not available for 10-year bonds. We have persisted in using a 20-year bond to keep the basis of the time series consistent.

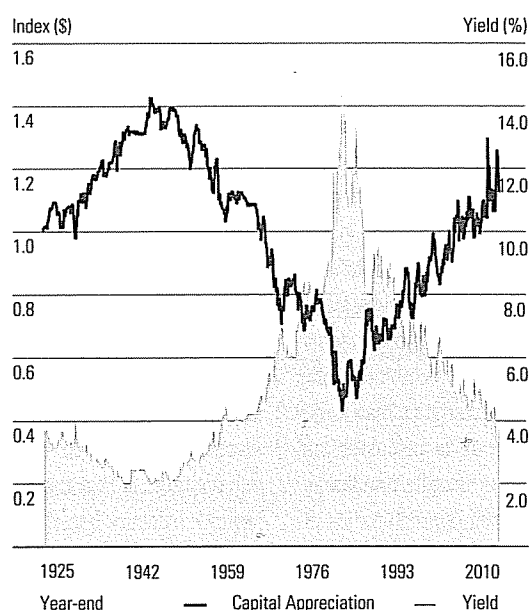
#### **Income Return**

Another point to keep in mind when calculating the equity risk premium is that the income return on the appropriate-horizon Treasury security, rather than the total return, is used in the calculation. The total return is comprised of three return components: the income return, the capital appreciation return, and the reinvestment return. The income return is defined as the portion of the total return that results from a periodic cash flow or, in this case, the bond coupon payment. The capital appreciation return results from the price change of a bond over a specific period. Bond prices generally change in reaction to unexpected fluctuations in yields. Reinvestment return is the return on a given month's investment income when reinvested into the same asset class in the subsequent months of the year. The income return is thus used in the estimation of the equity risk premium because it represents the truly riskless portion of the return.<sup>2</sup>

Yields have generally risen on the long-term bond over the 1926–2010 period, so it has experienced negative capital appreciation over much of this time. This trend has turned around since the 1980s, however. Graph 5-1 illustrates the yields on the long-term government bond series

compared to an index of the long-term government bond capital appreciation. In general, as yields rose, the capital appreciation index fell, and vice versa. Had an investor held the long-term bond to maturity, he would have realized the yield on the bond as the total return. However, in a constant maturity portfolio, such as those used to measure bond returns in this publication, bonds are sold before maturity (at a capital loss if the market yield has risen since the time of purchase). This negative return is associated with the risk of unanticipated yield changes.

**Graph 5-1: Long-term Government Bond Yields versus Capital Appreciation Index**



Data from 1925–2010.

For example, if bond yields rise unexpectedly, investors can receive a higher coupon payment from a newly issued bond than from the purchase of an outstanding bond with the former lower-coupon payment. The outstanding lower-coupon bond will thus fail to attract buyers, and its price will decrease, causing its yield to increase correspondingly, as its coupon payment remains the same. The newly priced outstanding bond will subsequently attract purchasers who will benefit from the shift in price and yield; however, those investors who already held the bond will suffer a capital loss due to the fall in price.

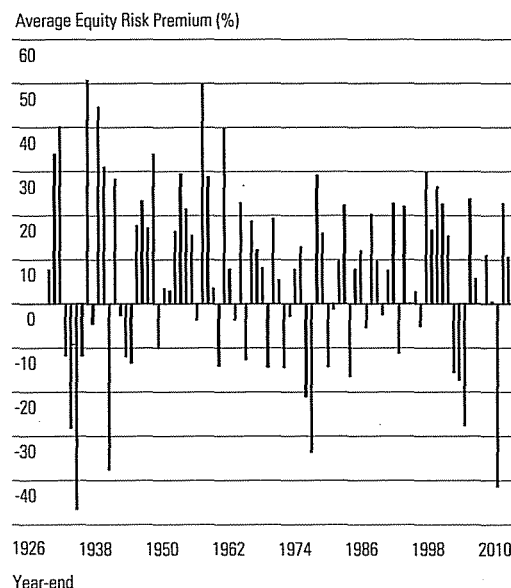
Anticipated changes in yields are assessed by the market and figured into the price of a bond. Future changes in yields that are not anticipated will cause the price of the bond to adjust accordingly. Price changes in bonds due to unanticipated changes in yields introduce price risk into the total return. Therefore, the total return on the bond series does not represent the riskless rate of return. The income return better represents the unbiased estimate of the purely riskless rate of return, since an investor can hold a bond to maturity and be entitled to the income return with no capital loss.

### Arithmetic versus Geometric Means

The equity risk premium data presented in this book are arithmetic average risk premia as opposed to geometric average risk premia. The arithmetic average equity risk premium can be demonstrated to be most appropriate when discounting future cash flows. For use as the expected equity risk premium in either the CAPM or the building block approach, the arithmetic mean or the simple difference of the arithmetic means of stock market returns and riskless rates is the relevant number. This is because both the CAPM and the building block approach are additive models, in which the cost of capital is the sum of its parts. The geometric average is more appropriate for reporting past performance, since it represents the compound average return.

The argument for using the arithmetic average is quite straightforward. In looking at projected cash flows, the equity risk premium that should be employed is the equity risk premium that is expected to actually be incurred over the future time periods. Graph 5-2 shows the realized equity risk premium for each year based on the returns of the S&P 500 and the income return on long-term government bonds. (The actual, observed difference between the return on the stock market and the riskless rate is known as the realized equity risk premium.) There is considerable volatility in the year-by-year statistics. At times the realized equity risk premium is even negative.

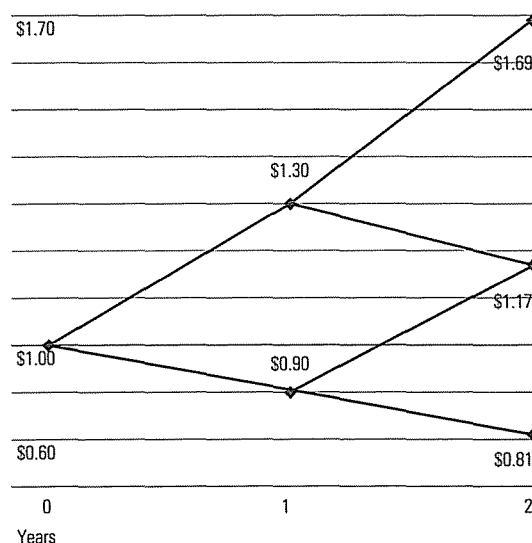
**Graph 5-2: Realized Equity Risk Premium Per Year**



Data from 1926–2010.

To illustrate how the arithmetic mean is more appropriate than the geometric mean in discounting cash flows, suppose the expected return on a stock is 10 percent per year with a standard deviation of 20 percent. Also assume that only two outcomes are possible each year: +30 percent and –10 percent (i.e., the mean plus or minus one standard deviation). The probability of occurrence for each outcome is equal. The growth of wealth over a two-year period is illustrated in Graph 5-3.

**Graph 5-3: Growth of Wealth Example**



The most common outcome of \$1.17 is given by the geometric mean of 8.2 percent. Compounding the possible outcomes as follows derives the geometric mean:

$$[(1 + 0.30) \times (1 - 0.10)]^{1/2} - 1 = 0.082$$

However, the expected value is predicted by compounding the arithmetic, not the geometric, mean. To illustrate this, we need to look at the probability-weighted average of all possible outcomes:

$(0.25 \times \$1.69)$	$= \$0.4225$
$+ (0.50 \times \$1.17)$	$= \$0.5850$
$+ (0.25 \times \$0.81)$	$= \$0.2025$
<b>Total</b>	<b>\$1.2100</b>

Therefore, \$1.21 is the probability-weighted expected value. The rate that must be compounded to achieve the terminal value of \$1.21 after 2 years is 10 percent, the arithmetic mean:

$$\$1 \times (1 + 0.10)^2 = \$1.21$$

The geometric mean, when compounded, results in the median of the distribution:

$$\$1 \times (1 + 0.082)^2 = \$1.17$$

The arithmetic mean equates the expected future value with the present value; it is therefore the appropriate discount rate.

### Appropriate Historical Time Period

The equity risk premium can be estimated using any historical time period. For the U.S., market data exists at least as far back as the late 1800s. Therefore, it is possible to estimate the equity risk premium using data that covers roughly the past 100 years.

Our equity risk premium covers the time period from 1926 to the present. The original data source for the time series comprising the equity risk premium is the Center for Research in Security Prices. CRSP chose to begin their analysis of market returns with 1926 for two main reasons. CRSP determined that the time period around 1926 was

approximately when quality financial data became available. They also made a conscious effort to include the period of extreme market volatility from the late twenties and early thirties; 1926 was chosen because it includes one full business cycle of data before the market crash of 1929. These are the most basic reasons why our equity risk premium calculation window starts in 1926.

Implicit in using history to forecast the future is the assumption that investors' expectations for future outcomes conform to past results. This method assumes that the price of taking on risk changes only slowly, if at all, over time. This "future equals the past" assumption is most applicable to a random time-series variable. A time-series variable is random if its value in one period is independent of its value in other periods.

### Does the Equity Risk Premium Revert to Its Mean Over Time?

Some have argued that the estimate of the equity risk premium is upwardly biased since the stock market is currently priced high. In other words, since there have been several years with extraordinarily high market returns and realized equity risk premia, the expectation is that returns and realized equity risk premia will be lower in the future, bringing the average back to a normalized level. This argument relies on several studies that have tried to determine whether reversion to the mean exists in stock market prices and the equity risk premium.<sup>3</sup> Several academics contradict each other on this topic; moreover, the evidence supporting this argument is neither conclusive nor compelling enough to make such a strong assumption.

Our own empirical evidence suggests that the yearly difference between the stock market total return and the U.S. Treasury bond income return in any particular year is random. Graph 5-2, presented earlier, illustrates the randomness of the realized equity risk premium.

A statistical measure of the randomness of a return series is its serial correlation. Serial correlation (or autocorrelation) is defined as the degree to which the return of a given series is related from period to period. A serial correlation near positive one indicates that returns are predictable from one

period to the next period and are positively related. That is, the returns of one period are a good predictor of the returns in the next period. Conversely, a serial correlation near negative one indicates that the returns in one period are inversely related to those of the next period. A serial correlation near zero indicates that the returns are random or unpredictable from one period to the next. Table 5-3 contains the serial correlation of the market total returns, the realized long-horizon equity risk premium, and inflation.

**Table 5-3: Interpretation of Annual Serial Correlations**

Series	Serial Correlation	Interpretation
Large Company Stock Total Returns	0.02	Random
Equity Risk Premium	0.02	Random
Inflation Rates	0.64	Trend

Data from 1926–2010.

The significance of this evidence is that the realized equity risk premium next year will not be dependent on the realized equity risk premium from this year. That is, there is no discernable pattern in the realized equity risk premium—it is virtually impossible to forecast next year's realized risk premium based on the premium of the previous year. For example, if this year's difference between the riskless rate and the return on the stock market is higher than last year's, that does not imply that next year's will be higher than this year's. It is as likely to be higher as it is lower. The best estimate of the expected value of a variable that has behaved randomly in the past is the average (or arithmetic mean) of its past values.

Table 5-4 also indicates that the equity risk premium varies considerably by decade. The complete decades ranged from a high of 17.9 percent in the 1950s to a low of -3.7 percent in the 2000s. This look at historical equity risk premium reveals no observable pattern.

**Table 5-4: Long-Horizon Equity Risk Premium by Decade (%)**

1920s*	1930s	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010-
17.6	2.3	8.0	17.9	4.2	0.3	7.9	12.1	-3.7	-1.1

Data from 1926–2010.

\*Based on the period 1926–1929.

Finnerty and Leistikow perform more econometrically sophisticated tests of mean reversion in the equity risk premium. Their tests demonstrate that—as we suspected from our simpler tests—the equity risk premium that was realized over 1926 to the present was almost perfectly free of mean reversion and had no statistically identifiable time trends.<sup>4</sup> Lo and MacKinlay conclude, “the rejection of the random walk for weekly returns does not support a mean-reverting model of asset prices.”

### Choosing an Appropriate Historical Period

The estimate of the equity risk premium depends on the length of the data series studied. A proper estimate of the equity risk premium requires a data series long enough to give a reliable average without being unduly influenced by very good and very poor short-term returns. When calculated using a long data series, the historical equity risk premium is relatively stable.<sup>5</sup> Furthermore, because an average of the realized equity risk premium is quite volatile when calculated using a short history, using a long series makes it less likely that the analyst can justify any number he or she wants. The magnitude of how shorter periods can affect the result will be explored later in this chapter.

Some analysts estimate the expected equity risk premium using a shorter, more recent time period on the basis that recent events are more likely to be repeated in the near future; furthermore, they believe that the 1920s, 1930s, and 1940s contain too many unusual events. This view is suspect because all periods contain “unusual” events. Some of the most unusual events of the last hundred years took place quite recently, including the inflation of the late 1970s and early 1980s, the October 1987 stock market crash, the collapse of the high-yield bond market, the major contraction and consolidation of the thrift industry, the collapse of the Soviet Union, the development of the European Economic Community, the attacks of September 11, 2001 and the more recent liquidity crisis of 2008 and 2009.

It is even difficult for economists to predict the economic environment of the future. For example, if one were analyzing the stock market in 1987 before the crash, it would be statistically improbable to predict the impending short-term volatility without considering the stock market crash and market volatility of the 1929–1931 period.

Without an appreciation of the 1920s and 1930s, no one would believe that such events could happen. The 85-year period starting with 1926 is representative of what can happen: it includes high and low returns, volatile and quiet markets, war and peace, inflation and deflation, and prosperity and depression. Restricting attention to a shorter historical period underestimates the amount of change that could occur in a long future period. Finally, because historical event-types (not specific events) tend to repeat themselves, long-run capital market return studies can reveal a great deal about the future. Investors probably expect “unusual” events to occur from time to time, and their return expectations reflect this.

### A Look at the Historical Results

It is interesting to take a look at the realized returns and realized equity risk premium in the context of the above discussion. Table 5-5 shows the average stock market return and the average (arithmetic mean) realized long-horizon equity risk premium over various historical time periods. Similarly, Graph 5-5 shows the average (arithmetic mean) realized equity risk premium calculated through 2010 for different ending dates. The table and the graph both show that using a longer historical period provides a more stable estimate of the equity risk premium. The reason is that any unique period will not be weighted heavily in an average covering a longer historical period. It better represents the probability of these unique events occurring over a long period of time.

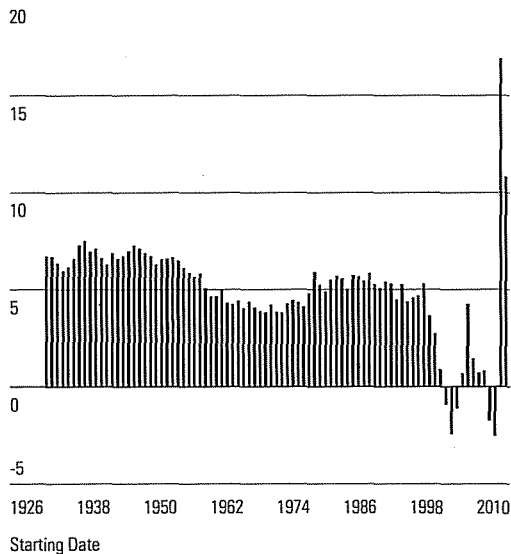
**Table 5-5: Stock Market Return and Equity Risk Premium Over Time**

Length (Yrs.)	Period Dates	Large Company Stock Arithmetic Mean Total Return (%)	Long-Horizon Equity Risk Premium (%)
85	1926–2010	11.8	6.7
70	1941–2010	12.6	7.0
60	1951–2010	12.3	6.1
50	1961–2010	11.2	4.4
40	1971–2010	11.8	4.5
30	1981–2010	12.2	5.0
20	1991–2010	11.0	5.3
15	1996–2010	8.9	3.7
10	2001–2010	3.6	-1.1
5	2006–2010	5.2	0.8

Data from 1926–2010.

**Graph 5-4: Equity Risk Premium Using Different Starting Dates**

Average Equity Risk Premium Through 2010 (%)



Data from 1926–2010.

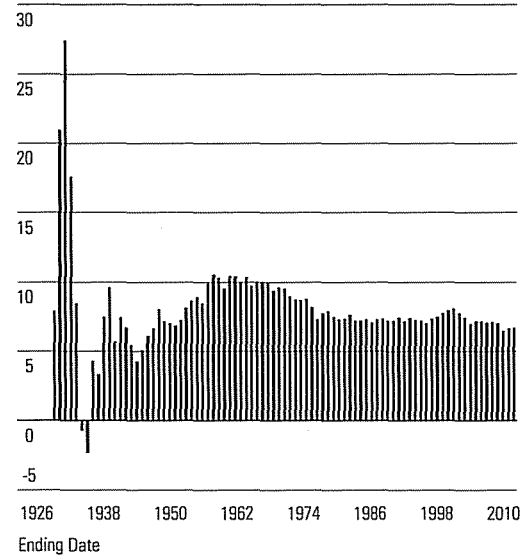
Looking carefully at Graph 5-4 will clarify this point. The graph shows the realized equity risk premium for a series of time periods through 2010, starting with 1926. In other words, the first value on the graph represents the average realized equity risk premium over the period 1926–2010. The next value on the graph represents the average realized equity risk premium over the period 1927–2010, and so on, with the last value representing the average over the most recent five years, 2006–2010. Concentrating on the left side of Graph 5-5, one notices that the realized equity risk premium, when measured over long periods of time, is relatively stable. In viewing the graph from left to right, moving from longer to shorter historical periods, one sees that the value of the realized equity risk premium begins to decline significantly. Why does this occur? The reason is that the severe bear market of 1973–1974 is receiving proportionately more weight in the shorter, more recent average. If you continue to follow the line to the right, however, you will also notice that when 1973 and 1974 fall out of the recent average, the realized equity risk premium jumps up by nearly 1.2 percent.

Additionally, use of recent historical periods for estimation purposes can lead to illogical conclusions. As seen in Table 5-5, the bear market in the early 2000's and in 2008 has caused the realized equity risk premium in the shorter historical periods to be lower than the long-term average.

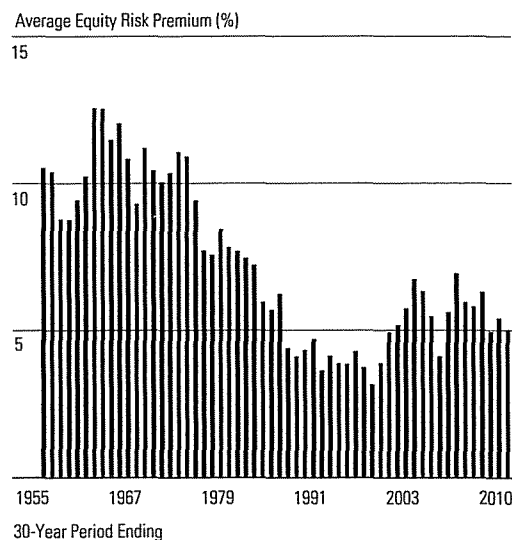
The impact of adding one additional year of data to a historical average is lessened the greater the initial time period of measurement. Short-term averages can be affected considerably by one or more unique observations. On the other hand, long-term averages produce more stable results. A series of graphs looking at the realized equity risk premium will illustrate this effect. Graph 5-5 shows the average (arithmetic mean) realized long-horizon equity risk premium starting in 1926. Each additional point on the graph represents the addition of another year to the average. Although the graph is extremely volatile in the beginning periods, the stability of the long-term average is quite remarkable. Again, the "unique" periods of time will not be weighted heavily in a long-term average, resulting in a more stable estimate.

**Graph 5-5: Equity Risk Premium Using Different Ending Dates**

Average Equity Risk Premium Beginning 1926 (%)



Data from 1926–2010.

**Graph 5-6: Equity Risk Premium Over 30-Year Periods**

Data from 1926–2010.

Some practitioners argue for a shorter historical time period, such as 30 years, as a basis for the equity risk premium estimation. The logic for the use of a shorter period is that historical events and economic scenarios present before this time are unlikely to be repeated. Graph 5-6 shows the equity risk premium measured over 30-year periods, and it appears from the graph that the premium has been trending downwards. The 30-year equity risk premium remained close to 4 percent for several years in the 1980s and 1990s. However, it has fallen and then risen in the most recent 30-year periods.

The key to understanding this result lies again in the years 1973 and 1974. The oil embargo during this period had a tremendous effect on the market. The equity risk premium for these years alone was -21 and -34 percent, respectively. Periods that include the years 1973 and 1974 result in an average equity risk premium as low as 3.1 percent. In the most recent 30-year periods that excludes 1973 and 1974, the average rises to over 6 percent. The 2000s have also had an enormous effect on the equity risk premium.

It is difficult to justify such a large divergence in estimates of return over such a short period of time. This does not suggest, however, that the years 1973 and 1974 should be excluded from any estimate of the equity risk premium; rather, it emphasizes the importance of using a long historical period when measuring the equity risk premium in order to obtain a reliable average that is not

overly influenced by short-term returns. The same holds true when analyzing the poor performance of the early 2000s and 2008.

### Does the Equity Risk Premium Represent Minority or Controlling Interest?

There is quite a bit of confusion among valuation practitioners regarding the use of publicly traded company data to derive the equity risk premium. Is a minority discount implicit in this data? Recall that the equity risk premium is typically derived from the returns of a market index: the S&P 500, the New York Stock Exchange (NYSE), or the NYSE Deciles 1–2. (The size premia that are covered in Chapter 7 are derived from the returns of companies traded on the NYSE, in addition to those on the NYSE AMEX and NASDAQ). Both the S&P 500 and the NYSE include a preponderance of companies that are minority held. Does this imply that an equity risk premium (or size premium) derived from these data represents a minority interest premium? This is a critical issue that must be addressed by the valuation professional, since applying a minority discount or a control premium can have a material impact on the ultimate value derived in an appraisal.

Since most companies in the S&P 500 and the NYSE are minority held, some assume that the risk premia derived from these return data represent minority returns and therefore have a minority discount implicit within them. However, this assumption is not correct. The returns that are generated by the S&P 500 and the NYSE represent returns to equity holders. While most of these companies are minority held, there is no evidence that higher rates of return could be earned if these companies were suddenly acquired by majority shareholders. The equity risk premium represents expected premiums that holders of securities of a similar nature can expect to achieve on average into the future. There is no distinction between minority owners and controlling owners.

The discount rate is meant to represent the underlying risk of being in a particular industry or line of business. There are instances when a majority shareholder can acquire a company and improve the cash flows generated by that company. However, this does not necessarily have an impact on the general risk level of the cash flows generated by the company.

When performing discounted cash flow analysis, adjustments for minority or controlling interest value may be more suitably made to the projected cash flows than to the discount rate. Adjusting the expected future cash flows better measures the potential impact a controlling party may have while not overstating or understating the actual risk associated with a particular line of business.

Appraisers need to note the distinction between a publicly traded value and a minority interest value. Most public companies have no majority or controlling owner. There is thus no distinction between owners in this setting. One cannot assume that publicly held companies with no controlling owner have the same characteristics as privately held companies with both a controlling interest owner and a minority interest owner.

#### **Other Equity Risk Premium Issues**

There are a number of other issues that are commonly brought up regarding the equity risk premium that, if correct, would reduce its size. These issues include:

1. Survivorship bias in the measurement of the equity risk premium
2. Utility theory models of estimating the equity risk premium
3. Reconciling the discounted cash flow approach to the equity risk premium
4. Over-valuation effects of the market
5. Changes in investor attitudes toward market conditions
6. Supply side models of estimating the equity risk premium

In this section, we will examine each of these issues.

#### **Survivorship**

One common problem in working with financial data is properly accounting for survivorship. In working with company-specific historical data, it is important for researchers to include data from companies that failed as well as companies that succeeded before drawing conclusions from elements of that data.

The same argument can be made regarding markets as a whole. The equity risk premium data outlined in this book represent data on the United States stock market. The United States has arguably been the most successful stock

market of the twentieth century. That being the case, might equity risk premium statistics based only on U.S. data overstate the returns of equities as a whole because they only focus on one successful market?

In a recent paper, Goetzmann and Jorion study this question by looking at returns from a number of world equity markets over the past century.<sup>6</sup> The Goetzmann-Jorion paper looks at the survivorship bias from several different perspectives. They conclude that once survivorship is taken into consideration the U.S. equity risk premium is overstated by approximately 60 basis points.<sup>7</sup> The non-U.S. equity risk premium was found to contain significantly more survivorship bias.

While the survivorship bias evidence may be compelling on a worldwide basis, one can question its relevance to a purely U.S. analysis. If the entity being valued is a U.S. company, then the relevant data set should be the performance of equities in the U.S. market.

#### **Equity Risk Premium Puzzle**

In 1985, Mehra and Prescott published a paper that discussed the equity risk premium from a utility theory perspective. The point that Mehra and Prescott make is that under existing economic theory, economists cannot justify the magnitude of the equity risk premium. The utility theory model employed was incapable of obtaining values consistent with those observed in the market.

This is an interesting point and may be worthy of further study, but it does not do anything to prove that the equity risk premium is too high. It may, on the other hand, indicate that theoretical economic models require further refinement to adequately explain market behavior.

#### **Discounted Cash Flow versus Capital Asset Pricing Model**

Two of the most commonly used cost of equity models are the discounted cash flow model and the capital asset pricing model. We should be able to reconcile the two models. In its basic form, the discounted cash flow model states that the expected return on equities is the dividend yield plus the expected long-term growth rate. The capital asset pricing model states that the expected return on equities is the risk-free rate plus the equity risk premium.<sup>8</sup>

For the discounted cash flow model we can obtain an estimate of the long-term growth rate for the entire economy by looking at its component parts. Real Gross Domestic Product growth has averaged approximately three percent over long periods of time. Long-term expected inflation is currently in the range of one percent. Combining these two numbers produces an expected long-term growth rate of about four percent. Dividend yields have been between two percent and three percent historically. The discounted cash flow expected equity return is thus between six percent and seven percent using these assumptions.

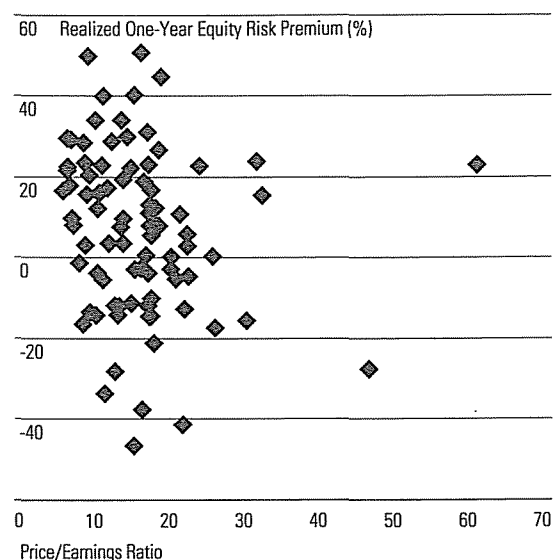
If we try to reconcile this expected equity return with that found using the capital asset pricing model, we find a significant discrepancy. The yield on government bonds has been about three percent. If the two models are to reconcile, the equity risk premium must be in the three to four percent range instead of the seven to eight percent range we have observed historically.

It is not easy to explain why these two models are so difficult to reconcile. While it is possible to modify the assumptions slightly, doing so still does not produce the desired results. One explanation might be that one or both of the models are too simplistic and therefore lack the ability to resolve this inconsistency.

### Market Bubbles

Another criticism of using the historical equity risk premium is that the market is overvalued. This argument is often offered after stock prices have seen a sustained increase. The logic of the argument is that abnormally high market returns drive the historical equity risk premium higher while at the same time driving the expected equity risk premium lower. As evidence of the market being overvalued, one can look at the price/earnings multiple of the market. Graph 5-7 attempts to demonstrate the relationship between the price/earnings multiple and the subsequent period's equity risk premium. If the above argument held, one would expect to find a low equity risk premium associated with a high price/earnings multiple from the prior period. One would also expect a high equity risk premium to be associated with a low price/earnings multiple in the prior period. From the graph there does not seem to be a clear indication of the market being overvalued or undervalued with respect to the next period's realized equity risk premium.

**Graph 5-7: Price-Earnings Multiple versus Subsequent Year's Realized Equity Risk Premium**

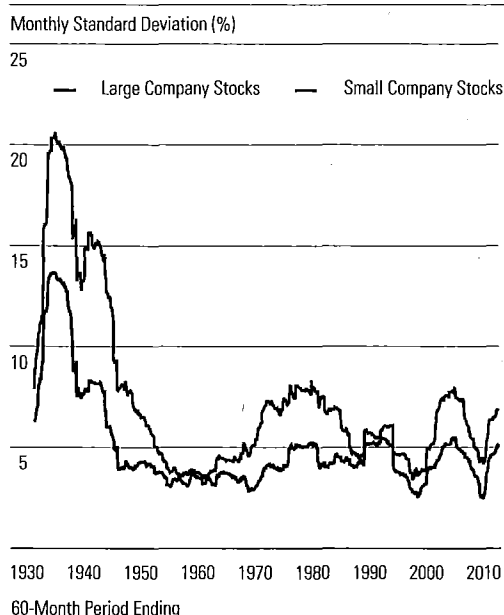


Data from 1926–2010. Source: Historical price/earnings ratios from Standard & Poor's Security Price Index Record and Compustat database.

There are yet other problems with this theory. First, the equity risk premium is measured over a long historical time period. Several years of strong market returns have a relatively small impact on the ultimate equity risk premium estimate. Second, we are attempting to forecast a long-term equity risk premium. Even if the market were to underperform over several consecutive time periods, this should not have a significant impact on expected long-term returns. Finally, one ratio does not necessarily tell the whole story. The price/earnings ratio shows the current stock price divided by the historical earnings per share. Stock prices should, on the other hand, incorporate expectations of future earnings growth. A high market price/earnings ratio may indicate that investors expect significant future earnings growth.

### Change in Investor Attitudes

There is no law that states that investor attitudes must remain constant over time. With the advent of 401(k) investing and the increase in education of the investing public, the market may have changed. In fact, stock returns have become less volatile over time. Graph 5-8 demonstrates a relative decline in the rolling 60-month standard deviation of both large and small stocks. (Standard deviation is a measure of the returns' volatility or risk.) This may suggest that we have moved into a new market regime in which stocks are less volatile and therefore require a lower risk premium than in the past.<sup>9</sup>

**Graph 5-8: Rolling 60-Month Standard Deviation for Large and Small Stocks**

Data from January 1926–December 2010.

There are two arguments against this rationale. First, it could easily be argued that we have moved through a series of market regimes during the 85-year history of the equity risk premium calculation window used in this book. Given that markets and investor attitudes have changed over time and the equity risk premium has remained relatively constant, there is no reason to believe that a new market regime will have any greater or lesser impact than any other time period.

A second argument relates to the demand for investments. If investors are more comfortable with the market and with stock investing, they will probably place more money into the market. This influx of funds will increase the demand for stocks, which will ultimately increase, not decrease, the equity risk premium.

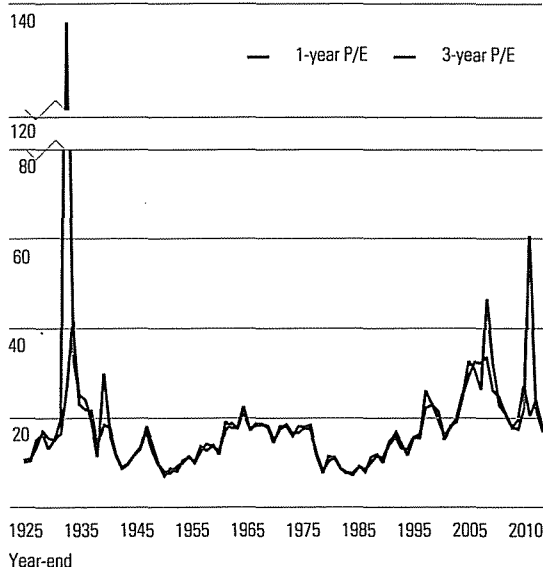
### Supply Model

Long-term expected equity returns can be forecasted by the use of supply side models. The supply of stock market returns is generated by the productivity of the corporations in the real economy. Investors should not expect a much higher or lower return than that produced by the companies in the real economy. Thus, over the long run, equity returns should be close to the long-run supply estimate.

Roger G. Ibbotson and Peng Chen forecast the equity risk premium through a supply side model using historical data.<sup>10</sup> They utilized an earnings model as the basis for their supply side estimate; historically, the growth in corporate earnings has been in line with the growth of overall economic productivity. The earnings model breaks historical returns into four pieces, with only three historically being supplied by companies: inflation, income return, and growth in real earnings per share. The growth in the P/E ratio, the fourth piece, is a reflection of investors' changing prediction of future earnings growth. The past supply of corporate growth is forecasted to continue; however, a change in investors' predictions is not. P/E rose dramatically from 1980 through 2001 because people believed that corporate earnings were going to grow faster in the future. This growth of P/E drove a small portion of the rise in equity returns over the same period.

Graph 5-9 illustrates the price to earnings ratio calculated using one-year and three-year average earnings from 1926 to 2010. The P/E ratio, using one-year average earnings, was 10.22 at the beginning of 1926 and ended the year 2010 at 16.79—an average increase of 0.59 percent per year. The highest P/E was 136.55 recorded in 1932, while the lowest was 25.06 recorded in 1948.

Ibbotson Associates revised the calculation of the P/E ratio from a one-year to a three-year average earnings for use in equity forecasting. This is because reported earnings are affected not only by the long-term productivity, but also by "one-time" items that do not necessarily have the same consistent impact year after year. The three-year average is more reflective of the long-term trend than the year-by-year numbers. The P/E ratio calculated using the three-year average of earnings had an increase of 1.66 percent per year.

**Graph 5-9: Large Company Stocks**

The historical P/E growth factor using three-year earnings of 1.66 percent per year is subtracted from the forecast because it is not believed that P/E will continue to increase in the future. The market serves as the cue. The current P/E ratio is the market's best guess for the future of corporate earnings and there is no reason to believe, at this time, that the market will change its mind.

Thus, the supply of equity returns only includes inflation, the growth in real earnings per share, and income return:

$$SR = [(1 + CPI) \times (1 + g_{REPS}) - 1] + Inc + Rinv$$

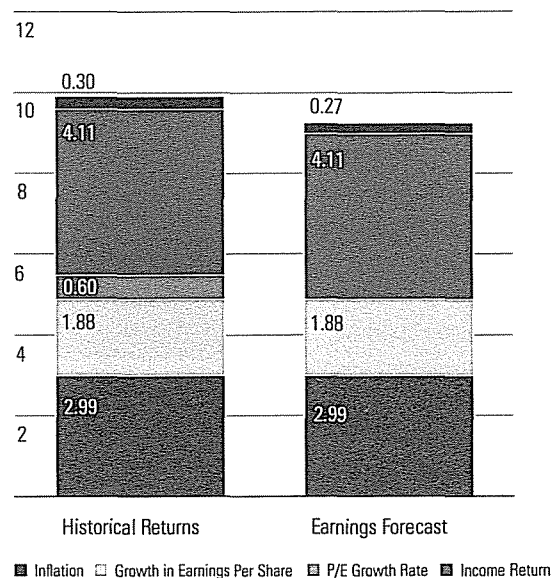
$$9.24\% = [(1 + 2.99\%) \times (1 + 1.88\%) - 1] + 4.11\% + 0.21\%$$

\*difference due to rounding

where:

- SR = the supply of the equity return;
- CPI = Consumer Price Index (inflation);
- $g_{REPS}$  = the growth in real earning per share;
- Inc = the income return;
- Rinv = the reinvestment return.

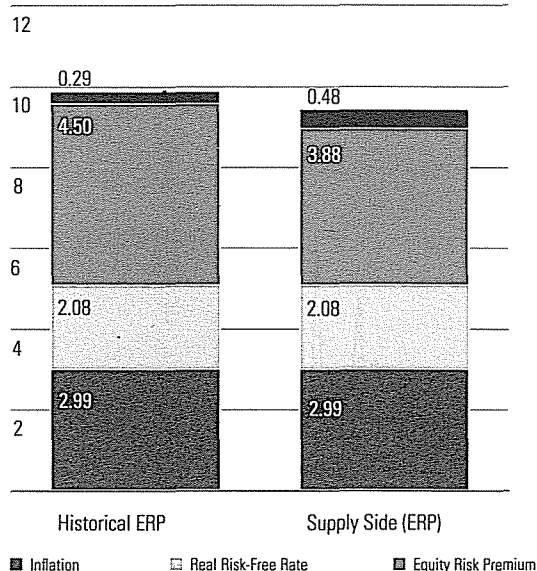
The forward-looking earnings model calculates the long-term supply of U.S. equity returns to be 9.24 percent.

**Graph 5-10: Historical and Forecast Equity Returns Based on Earnings Model**

■ Inflation □ Growth in Earnings Per Share ■ P/E Growth Rate ■ Income Return

Data from 1926-2010. Results add up geometrically, not arithmetically. The darkest shade in the graph represents reinvested returns and an interaction factor between the return components.

Graph 5-10 illustrates the decomposition of historical equity returns from 1926-2010. It also illustrates the historical components that are supplied by companies: inflation, income return, and growth in real earnings per share. Once again the main difference between the historical and forecast equity returns is the exclusion of growth in P/E ratio in the forecasted earnings model.

**Graph 5-11: Historical and Forecast Equity Risk Premium**

Data from 1926–2010. Results add up geometrically, not arithmetically. The darkest shade in the graph represents reinvested returns and an interaction factor between the return components.

**Table 5-6: Supply Side and Historical Equity Risk Premium Over Time**

Period Length (Yrs.)	Period Dates	g(P/E)	Arithmetic Average Supply Side Equity Risk Premium (%)	Historical Equity Risk Premium (%)
85	1926–2010	0.60	5.96	6.72
84	1926–2009	0.96	5.55	6.67
83	1926–2008	0.79	5.53	6.47
82	1926–2007	1.15	5.74	7.06
81	1926–2006	0.75	6.22	7.13
80	1926–2005	0.65	6.29	7.08
79	1926–2004	0.83	6.18	7.17
78	1926–2003	1.09	5.94	7.19
77	1926–2002	1.17	5.65	6.97
76	1926–2001	1.53	5.71	7.43
75	1926–2000	1.49	6.06	7.76
74	1926–1999	1.52	6.32	8.07
73	1926–1998	1.40	6.35	7.97
72	1926–1997	1.20	6.37	7.77
71	1926–1996	0.87	6.46	7.50
70	1926–1995	0.74	6.47	7.37
69	1926–1994	0.59	6.32	7.04
68	1926–1993	0.90	6.17	7.22
67	1926–1992	1.15	5.98	7.29
66	1926–1991	1.12	6.12	7.39
65	1926–1990	0.67	6.36	7.16
64	1926–1989	0.60	6.72	7.45
63	1926–1988	0.32	6.78	7.21
62	1926–1987	0.36	6.74	7.20

Data from 1926–2010.

The Supply Side equity risk premium is calculated to be 3.91 percent on a geometric basis.

$$SERP = \frac{(1+SR)}{(1+CPI) \times (1+RRf)} - 1$$

$$3.91\% = \frac{(1+9.24\%)}{(1+2.99\%) \times (1+2.08\%)} - 1$$

\*difference due to rounding.

where:

SERP = the supply side equity risk premium;  
 SR = the supply of the equity return;  
 CPI = Consumer Price Index (inflation); and,  
 RRf = the real risk-free rate.

Graph 5-11 compares the historical equity risk premium, which includes the P/E ratio, to the supply side equity risk premium calculated from 1926 to 2010 on a geometric basis. Contrary to several recent studies on equity risk premium that declare the forward-looking equity risk premium to be close to zero, or even negative, Ibbotson and Chen have found the long-term supply of equity risk premium to be only slightly lower than the straight historical estimate.

The supply side equity risk premium calculated earlier is a geometric calculation. An arithmetic calculation, as mentioned earlier in the chapter, is most appropriate when discounting future cash flows. For use as the expected equity risk premium in either the CAPM or the buildup approach, the arithmetic calculation is the relevant number. There are several ways to convert the geometric average into an arithmetic average. One method is to assume the returns are independently lognormally distributed over time, where the arithmetic and geometric averages roughly follow the following relationship:

$$R_A = R_G + \frac{\sigma^2}{2}$$

$$5.99\% = 3.88\% + \frac{20.51\%^2}{2}$$

where:

$R_A$  = the arithmetic average;  
 $R_G$  = the geometric average;  
 $\sigma$  = the standard deviation of equity returns.

As stated in IRS Ruling 59-60, although valuation is a forward-looking process, it must be based on facts available as of the required date of appraisal. Therefore, Ibbotson provides data critical to the valuation process as far back as 1926, such as the historical equity risk premium and size premium presented in Appendix A of this book. Similarly, Table 5-6 presents the supply side equity risk premium, on an arithmetic basis, beginning in 1926 and ending in each of the last 25 years.

As mentioned earlier, one of the key findings of the Ibbotson and Chen study is that P/E increases account for only a small portion of the total return of equity. The reason we present supply side equity risk premium going back only 25 years is because the P/E ratio rose dramatically over this time period, which caused the growth rate in the P/E ratio calculated from 1926 to be relatively high. The subtraction of the P/E growth factor from equity returns has been responsible for the downward adjustment in the supply side equity risk premium compared to the historical estimate. Beyond the last 25 years, the growth factor in the P/E ratio has not been dramatic enough to require an adjustment.

This section has briefly reviewed some of the more common arguments that seek to reduce the equity risk premium. While some of these theories are compelling in an academic framework, most do little to prove that the equity risk premium is too high. When examining these theories, it is important to remember that the equity risk premium data outlined in this book (both the historical and supply side estimates) are from actual market statistics over a long historical time period.

#### **Taxes and Equity Risk Premium Calculations**

All of the risk premium statistics included in this publication are derived from market returns earned by an investor. The investor receives dividends and realizes price appreciation after the corporation has paid its taxes. Therefore, it is implicit that the market return data represents returns after corporate taxes but before personal taxes.

When performing a discounted cash flow analysis, both the discount rate and the cash flows should be on the same tax basis. Most valuation settings rely on after-tax cash flows; the use of an after-tax discount rate would thus be appropriate in most cases. However, there are some instances (usually because of regulatory or legal statute reasons) in which it is necessary to calculate a pre-tax value. In these cases, a pre-tax cost of capital or discount rate should be employed. There is no easy way, however, to accurately modify the return on a market index to a pre-tax basis. This modification would require estimating pre-tax returns for all of the publicly traded companies that comprise the market benchmark.

This presents a problem when a pre-tax discounted cash flow analysis is required. Although not completely correct, the easiest way to convert an after-tax discount rate to a pre-tax discount rate is to divide the after-tax rate by (1 minus the tax rate). This adjustment should be made to the entire discount rate and not to its component parts (i.e., the equity risk premium). Take note that this is a "quick and dirty" way to approximate pre-tax discount rates.

The tax rate to use in this "quick and dirty" method presents yet another problem. As seen in the discussion of the weighted average cost of capital in Chapter 1, companies do not always pay the top marginal tax rate. New research has shown some progress in quantifying the expected future tax rates. See Chapter 1 for more detail. ■■■

## Endnotes

<sup>1</sup> **Page 53** Ibbotson, Roger G., Jeffrey J. Diermeier, and Laurence B. Siegel. "The Demand for Capital Market Returns: A New Equilibrium Theory," *Financial Analysts Journal*, January/February, vol. 40, no. 1, 1984, pp. 22-33. Mehra, Rajnish and Edward Prescott. "The Equity Premium: A Puzzle," *Journal of Monetary Economics*, vol. 15, no. 2, 1985, pp. 145-161.

<sup>2</sup> **Page 55** Please note that the appropriate forward-looking measure of the riskless rate is the yield to maturity on the appropriate-horizon government bond. This differs from the riskless rate used to measure the realized equity risk premium historically. Chapter 4 includes a thorough discussion of riskless rate selection in this context.

<sup>3</sup> **Page 58** Fama, Eugene F., and Kenneth R. French. "Permanent and Temporary Components of Stock Prices," *Journal of Political Economy*, April 1988, pp. 246-273.

Poterba, James M., and Lawrence H. Summers. "Mean Reversion in Stock Prices," *Journal of Financial Economics*, October 1988, pp. 27-59.

Lo, Andrew W., and A. Craig MacKinlay. "Stock Market Prices Do Not Follow Random Walks: Evidence from a Simple Specification Test," *The Review of Financial Studies*, Spring 1988, pp. 41-66.

Finnerty, John D., and Dean Leistikow. "The Behavior of Equity and Debt Risk Premiums: Are They Mean Reverting and Downward-Trending?" *The Journal of Portfolio Management*, Summer 1993, pp. 73-84.

Ibbotson, Roger G., and Scott L. Lummer. "The Behavior of Equity and Debt Risk Premiums: Comment," *The Journal of Portfolio Management*, Summer 1994, pp. 98-100.

Finnerty, John D., and Dean Leistikow. "The Behavior of Equity and Debt Risk Premiums: Reply to Comment," *The Journal of Portfolio Management*, Summer 1994, pp. 101-102.

<sup>4</sup> **Page 59** Though the study performed by Finnerty and Leistikow demonstrates that the traditional equity risk premium exhibits no mean reversion or drift, they conclude that, "the processes generating these risk premiums are generally mean-reverting." This conclusion is completely unrelated to their statistical findings and has received some criticism. In addition to examining the traditional equity risk premium, Finnerty and Leistikow include analyses on "real" risk premium as well as separate risk premium for income and capital gains. In their comments on the study, Ibbotson and Lummer show that these "real" risk premium adjust for inflation twice, "creating variables with no economic content." In addition, separating income and capital gains does not shed light on the behavior of the risk premium as a whole.

<sup>5</sup> **Page 59** This assertion is further corroborated by data presented in *Global Investing: The Professional's Guide to the World of Capital Markets* (by Roger G. Ibbotson and Gary P. Brinson and published by McGraw-Hill, New York). Ibbotson and Brinson constructed a stock market total return series back to 1790. Even with some uncertainty about the accuracy of the data before the mid-nineteenth century, the results are remarkable. The real (adjusted for inflation) returns that investors received during the three 50-year periods and one 51-year period between 1790 and 1990 did not differ greatly from one another (that is, in a statistically significant amount). Nor did the real returns differ greatly from the overall 201-year average. This finding implies that because real stock market returns have been reasonably consistent over time, investors can use these past returns as reasonable bases for forming their expectations of future returns.

<sup>6</sup> **Page 62** Goetzmann, William, and Philippe Jorion. "A Century of Global Stock Markets," Working Paper 5901, National Bureau of Economic Research, 1997.

<sup>7</sup> **Page 62** Note that the equity risk premium referred to in the Goetzmann and Jorion paper is not the same as the equity risk premium covered in this publication. Among other differences, their equity risk premium is based on a longer history of data and does not take dividend income or reinvestment into account.

<sup>8</sup> **Page 62** The discounted cash flow model is a modification of the Gordon Growth model, which states that: where  $P_0$  is the price of the security today,  $D_1$  is the dividend from next period,  $k$  is the cost of equity, and  $g$  is the expected growth rate in dividends. The capital asset pricing model is stated as  $k_i = \beta_i (ERP) + r_f$  where  $k_i$  is the cost of equity for company  $i$ ,  $\beta_i$  is the beta for company  $i$ , ERP is the equity risk premium, and  $r_f$  is the risk-free rate. For the market as a whole, the capital asset pricing model can be written as  $k = ERP + r_f$  because the market beta, by definition, is 1. For more information on these models, see Chapter 4.

<sup>9</sup> **Page 63** Note that the recent increase in market volatility, particularly in 1998, may also place into question the validity of this argument.

<sup>10</sup> **Page 64** Ibbotson, Roger G., and Peng Chen. "Long-Run Stock Returns: Participating in the Real Economy," *Financial Analysts Journal*, January/February, vol. 59, no. 1, 2003, pp. 88-98.



## The Equity Premium

Eugene F. Fama; Kenneth R. French

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## The Equity Premium

EUGENE F. FAMA and KENNETH R. FRENCH\*

### ABSTRACT

We estimate the equity premium using dividend and earnings growth rates to measure the expected rate of capital gain. Our estimates for 1951 to 2000, 2.55 percent and 4.32 percent, are much lower than the equity premium produced by the average stock return, 7.43 percent. Our evidence suggests that the high average return for 1951 to 2000 is due to a decline in discount rates that produces a large unexpected capital gain. Our main conclusion is that the average stock return of the last half-century is a lot higher than expected.

THE EQUITY PREMIUM—the difference between the expected return on the market portfolio of common stocks and the risk-free interest rate—is important in portfolio allocation decisions, estimates of the cost of capital, the debate about the advantages of investing Social Security funds in stocks, and many other applications. The average return on a broad portfolio of stocks is typically used to estimate the expected market return. The average real return for 1872 to 2000 on the S&P index (a common proxy for the market portfolio, also used here) is 8.81 percent per year. The average real return on six-month commercial paper (a proxy for the risk-free interest rate) is 3.24 percent. This large spread (5.57 percent) between the average stock return and the interest rate is the source of the so-called equity premium puzzle: Stock returns seem too high given the observed volatility of consumption (Mehra and Prescott (1985)).

We use fundamentals (dividends and earnings) to estimate the expected stock return. Along with other evidence, the expected return estimates from fundamentals help us judge whether the realized average return is high or low relative to the expected value.

The logic of our approach is straightforward. The average stock return is the average dividend yield plus the average rate of capital gain:

$$A(R_t) = A(D_t/P_{t-1}) + A(GP_t), \quad (1)$$

\* Fama is from the University of Chicago and French is from Dartmouth College. The comments of John Campbell, John Cochrane, Kent Daniel, John Heaton, Jay Ritter, Andrei Shleifer, Rex Sinquefeld, Tuomo Vuolteenaho, Paul Zarowin, and seminar participants at Boston College, Dartmouth College, the NBER, Purdue University, the University of Chicago, and Washington University have been helpful. Richard Green (the editor) and the two referees get special thanks.

where  $D_t$  is the dividend for year  $t$ ,  $P_{t-1}$  is the price at the end of year  $t - 1$ ,  $GP_t = (P_t - P_{t-1})/P_{t-1}$  is the rate of capital gain, and  $A(\cdot)$  indicates an average value. (Throughout the paper, we refer to  $D_t/P_{t-1}$  as the dividend yield and  $D_t/P_t$  is the dividend–price ratio. Similarly,  $Y_t/P_{t-1}$ , the ratio of earnings for year  $t$  to price at the end of year  $t - 1$ , is the earnings yield and  $Y_t/P_t$  is the earnings–price ratio.)

Suppose the dividend–price ratio,  $D_t/P_t$ , is stationary (mean reverting). Stationarity implies that if the sample period is long, the compound rate of dividend growth approaches the compound rate of capital gain. Thus, an alternative estimate of the expected stock return is

$$A(RD_t) = A(D_t/P_{t-1}) + A(GD_t), \quad (2)$$

where  $GD_t = (D_t - D_{t-1})/D_{t-1}$  is the growth rate of dividends. We call (2) the dividend growth model.

The logic that leads to (2) applies to any variable that is cointegrated with the stock price. For example, the dividend–price ratio may be non-stationary because firms move away from dividends toward share repurchases as a way of returning earnings to stockholders. But if the earnings–price ratio,  $Y_t/P_t$ , is stationary, the average growth rate of earnings,  $A(GY_t) = A((Y_t - Y_{t-1})/Y_{t-1})$ , is an alternative estimate of the expected rate of capital gain. And  $A(GY_t)$  can be combined with the average dividend yield to produce another estimate of the expected stock return:

$$A(RY_t) = A(D_t/P_{t-1}) + A(GY_t). \quad (3)$$

We call (3) the earnings growth model.<sup>1</sup>

We should be clear about the expected return concept targeted by (1), (2), and (3).  $D_t/P_t$  and  $Y_t/P_t$  vary through time because of variation in the conditional (point-in-time) expected stock return and the conditional expected growth rates of dividends and earnings (see, e.g., Campbell and Shiller (1989)). But if the stock return and the growth rates are stationary (they have constant unconditional means),  $D_t/P_t$  and  $Y_t/P_t$  are stationary. Then, like the average return (1), the dividend and earnings growth models (2) and (3) provide estimates of the unconditional expected stock return. In short, the focus of the paper is estimates of the unconditional expected stock return.

The estimate of the expected real equity premium for 1872 to 2000 from the dividend growth model (2) is 3.54 percent per year. The estimate from the average stock return, 5.57 percent, is almost 60 percent higher. The difference between the two is largely due to the last 50 years. The equity premium for 1872 to 1950 from the dividend growth model, 4.17 percent per year, is close to the estimate from the average return, 4.40 percent. In con-

<sup>1</sup> Motivated by the model in Lettau and Ludvigson (2001), one can argue that if the ratio of consumption to stock market wealth is stationary, the average growth rate of consumption is another estimate of the expected rate of capital gain. We leave this path to future work.

trast, the equity premium for 1951 to 2000 produced by the average return, 7.43 percent per year, is almost three times the estimate, 2.55 percent, from (2). The estimate of the expected real equity premium for 1951 to 2000 from the earnings growth model (3), 4.32 percent per year, is larger than the estimate from the dividend growth model (2). But the earnings growth estimate is still less than 60 percent of the estimate from the average return.

Three types of evidence suggest that the lower equity premium estimates for 1951 to 2000 from fundamentals are closer to the expected premium. (a) The estimates from fundamentals are more precise. For example, the standard error of the estimate from the dividend growth model is less than half the standard error of the estimate from the average return. (b) The Sharpe ratio for the equity premium from the average stock return for 1951 to 2000 is just about double that for 1872 to 1950. In contrast, the equity premium from the dividend growth model has a similar Sharpe ratio for 1872 to 1950 and 1951 to 2000. (c) Most important, valuation theory specifies relations among the book-to-market ratio, the return on investment, and the cost of equity capital (the expected stock return). The estimates of the expected stock return for 1951 to 2000 from the dividend and earnings growth models line up with other fundamentals in the way valuation theory predicts. But the book-to-market ratio and the return on investment suggest that the expected return estimate from the average stock return is too high.

Our motivation for the dividend growth model (2) is simpler and more general, but (2) can be viewed as the expected stock return estimate of the Gordon (1962) model. Our work is thus in the spirit of a growing literature that uses valuation models to estimate expected returns (e.g., Blanchard (1993), Claus and Thomas (2001), and Gebhardt, Lee, and Swaminathan (2001)). Claus and Thomas and Gebhardt, Lee, and Swaminathan use forecasts by security analysts to estimate expected cash flows. Their analyst forecasts cover short periods (1985 to 1998 and 1979 to 1995). We use realized dividends and earnings from 1872 to 2000. This 129-year period provides a long perspective, which is important for judging the competing expected return estimates from fundamentals and realized stock returns. Moreover, though the issue is controversial (Keane and Runkle (1998)), Claus and Thomas find that analyst forecasts are biased; they tend to be substantially above observed growth rates. The average growth rates of dividends and earnings we use are unbiased estimates of expected growth rates.

Like us, Blanchard (1993) uses dividend growth rates to estimate the expected rate of capital gain, which he combines with an expected dividend yield to estimate the expected stock return. But his focus is different and his approach is more complicated than ours. He is interested in the path of the conditional expected stock return. His conditional expected return is the sum of the fitted values from time-series regressions of the realized dividend yield and a weighted average of 20 years of future dividend growth rates on four predetermined variables (the dividend yield, the real rate of capital gain, and the levels of interest rates and inflation). He focuses on describing the path of the conditional expected return in terms of his four explanatory variables.

In contrast, our prime interest is the unconditional expected return, which we estimate more simply as the sum of the average dividend yield and the average growth rate of dividends or earnings. This approach is valid if the dividend–price and earnings–price ratios are stationary. And we argue below that it continues to produce estimates of the average expected stock return when the price ratios are subject to reasonable forms of nonstationarity. Given its simplicity and generality, our approach is an attractive addition to the research toolbox for estimating the expected stock return.

Moreover, our focus is comparing alternative estimates of the unconditional expected stock return over the long 1872 to 2000 period, and explaining why the expected return estimates for 1951 to 2000 from fundamentals are much lower than the average return. Our evidence suggests that much of the high return for 1951 to 2000 is unexpected capital gain, the result of a decline in discount rates.

Specifically, the dividend–price and earnings–price ratios fall from 1950 to 2000; the cumulative percent capital gain for the period is more than three times the percent growth in dividends or earnings. All valuation models agree that the two price ratios are driven by expectations about future returns (discount rates) and expectations about dividend and earnings growth. Confirming Campbell (1991), Cochrane (1994), and Campbell and Shiller (1998), we find that dividend and earnings growth rates for 1950 to 2000 are largely unpredictable. Like Campbell and Shiller (1998), we thus infer that the decline in the price ratios is mostly due to a decline in expected returns. Some of this decline is probably expected, the result of reversion of a high 1950 conditional expected return to the unconditional mean. But most of the decline in the price ratios seems to be due to the unexpected decline of expected returns to ending values far below the mean.

The paper proceeds as follows. The main task, addressed in Sections I and II, is to compare and evaluate the estimates of the unconditional annual expected stock return provided by the average stock return and the dividend and earnings growth models. Section III then considers the issues that arise if the goal is to estimate the long-term expected growth of wealth, rather than the unconditional expected annual (simple) return. Section IV concludes.

## **I. The Unconditional Annual Expected Stock Return**

Table I shows estimates of the annual expected real equity premium for 1872 to 2000. The market portfolio is the S&P 500 and its antecedents. The deflator is the Producer Price Index until 1925 (from Shiller (1989)) and the Consumer Price Index thereafter (from Ibbotson Associates). The risk-free interest rate is the annual real return on six-month commercial paper, rolled over at midyear. The risk-free rate and S&P earnings data are from Shiller, updated by Vuolteenaho (2000) and us. Beginning in 1925, we construct S&P book equity data from the book equity data in Davis, Fama, and French (2000), expanded to include all NYSE firms. The data on dividends, prices, and returns for 1872 to 1925 are from Shiller. Shiller's annual data on the

**Table I**  
**Real Equity Premium and Related Statistics for the S&P Portfolio**

The inflation rate for year  $t$  is  $\ln I_t^c = L_t/L_{t-1} - 1$ , where  $L_t$  is the price level at the end of year  $t$ . The real return for year  $t$  on six-month (three-month for the year 2000) commercial paper (rolled over at midyear) is  $F_t$ . The nominal values of book equity and price for the S&P index at the end of year  $t$  are  $b_t$  and  $p_t$ . Nominal S&P dividends and earnings for year  $t$  are  $d_t$  and  $y_t$ . Real rates of growth of dividends, earnings, and the stock price are  $GD_t = (d_t/d_{t-1}) * (L_{t-1}/L_t) - 1$ ,  $GY_t = (y_t/y_{t-1}) * (L_{t-1}/L_t) - 1$ . The real dividend yield is  $DD_t/P_{t-1} = (d_t/p_{t-1}) * (L_{t-1}/L_t)$ . The real income return on investment is  $Y_t/B_{t-1} = (1 + y_t/b_{t-1}) * (L_{t-1}/L_t) - 1$ . The dividend growth estimate of the real S&P return for  $t$  is  $RD_t = D_t/P_{t-1} + GD_t$ , the earnings growth estimate is  $RY_t = D_t/P_{t-1} + GY_t$ , and  $R_t$  is the realized real S&P return. The dividend and earnings growth estimates of the real equity premium for year  $t$  are  $RXD_t = RD_t - F_t$  and  $RXY_t = RY_t - F_t$ , and  $RX_t = R_t - F_t$  is the real equity premium from the realized real return. The Sharpe ratio for  $RD_t - F_t$  (the mean of  $RD_t - F_t$  divided by the standard deviation of  $R_t$ ) is  $SD$ ,  $SY$  is the Sharpe ratio for  $RY_t - F_t$  (the mean of  $RY_t - F_t$  divided by the standard deviation of  $R_t$ ), and  $SR$  is the Sharpe ratio for  $R_t - F_t$  (the mean of  $R_t - F_t$  divided by the standard deviation of  $R_t$ ). Except for the Sharpe ratios, all variables are expressed as percentages, that is, they are multiplied by 100.

[illegible]

level of the S&P (used to compute returns and other variables involving price) are averages of daily January values. The S&P dividend, price, and return data for 1926 to 2000 are from Ibbotson Associates, and the returns for 1926 to 2000 are true annual returns.

Without showing the details, we can report that the CRSP value-weight portfolio of NYSE, AMEX, and Nasdaq stocks produces average returns and dividend growth estimates of the expected return close to the S&P estimates for periods after 1925 when both indices are available. What one takes to be the risk-free rate has a bigger effect. For example, substituting the one-month Treasury bill rate for the six-month commercial paper rate causes estimates of the annual equity premium for 1951 to 2000 to rise by about one percent. But for our main task—comparing equity premium estimates from (1), (2), and (3)—differences in the risk-free rate are an additive constant that does not affect inferences.

One can estimate expected returns in real or nominal terms. Since portfolio theory says the goal of investment is consumption, real returns seem more relevant, and only results for real returns are shown. Because of suspicions about the quality of the price deflator during the early years of 1872 to 2000, we have replicated the results for nominal returns. They support all the inferences from real returns.

The dividend and earnings growth models (2) and (3) assume that the market dividend–price and earnings–price ratios are stationary. The first three annual autocorrelations of  $D_t/P_t$  for 1872 to 2000 are 0.73, 0.51, and 0.47. For the 1951 to 2000 period that occupies much of our attention, the autocorrelations are 0.83, 0.72, and 0.69. The autocorrelations are large, but their decay is roughly like that of a stationary first-order autoregression (AR1). This is in line with formal evidence (Fama and French (1988), Cochrane (1994), and Lamont (1998)) that the market dividend–price ratio is highly autocorrelated but slowly mean-reverting. S&P earnings data for the early years of 1872 to 2000 are of dubious quality (Shiller (1989)), so we estimate expected returns with the earnings growth model (3) only for 1951 to 2000. The first three autocorrelations of  $Y_t/P_t$  for 1951 to 2000, 0.80, 0.70, and 0.61, are again roughly like those of a stationary AR1.

We emphasize, however, that our tests are robust to reasonable nonstationarity of  $D_t/P_t$  and  $Y_t/P_t$ . It is not reasonable that the expected stock return and the expected growth rates of dividends and earnings that drive  $D_t/P_t$  and  $Y_t/P_t$  are nonstationary processes that can wander off to infinity. But nonstationarity of  $D_t/P_t$  and  $Y_t/P_t$  due to structural shifts in productivity or preferences that permanently change the expected return or the expected growth rates is reasonable. Such regime shifts are not a problem for the expected return estimates from (2) and (3), as long as  $D_t/P_t$  and  $Y_t/P_t$  mean-revert within regimes. If the regime shift is limited to expected dividend and earnings growth rates, the permanent change in expected growth rates is offset by a permanent change in the expected dividend yield, and (2) and (3) continue to estimate the (stationary) expected stock return. (An Appendix, available on request, provides an example.) If there is a perma-

nent shift in the expected stock return, it is nonstationary, but like the average return in (1), the dividend and earnings growth models in (2) and (3) estimate the average expected return during the sample period.

Indeed, an advantage of the expected return estimates from fundamentals is that they are likely to be less sensitive than the average return to long-lived shocks to dividend and earnings growth rates or the expected stock return. For example, a permanent shift in the expected return affects the average dividend yield, which is common to the three expected return estimates, but it produces a shock to the capital gain term in the average return in (1) that is not shared by the estimates in (2) and (3). In short, the estimates of the expected stock return from fundamentals are likely to be more precise than the average stock return.

#### *A. The Equity Premium*

For much of the period from 1872 to 2000—up to about 1950—the dividend growth model and the average stock return produce similar estimates of the expected return. Thereafter, the two estimates diverge. To illustrate, Table I shows results for 1872 to 1950 (79 years) and 1951 to 2000 (50 years). The year 1950 is a big year, with a high real stock return (23.40 percent), and high dividend and earnings growth estimates of the return (29.96 percent and 24.00 percent). But because the three estimates of the 1950 return are similarly high, the ordering of expected return estimates, and the inferences we draw from them, are unaffected by whether 1950 is allocated to the earlier or the later period. Indeed, pushing the 1950 break-year backward or forward several years does not affect our inferences.

For the earlier 1872 to 1950 period, there is not much reason to favor the dividend growth estimate of the expected stock return over the average return. Precision is not an issue; the standard errors of the two estimates are similar (1.74 percent and 2.12 percent), the result of similar standard deviations of the annual dividend growth rate and the rate of capital gain, 15.28 percent and 18.48 percent. Moreover, the dividend growth model and the average return provide similar estimates of the expected annual real return for 1872 to 1950, 8.07 percent and 8.30 percent. Given similar estimates of the expected return, the two approaches produce similar real equity premiums for 1872 to 1950, 4.17 percent (dividend growth model) and 4.40 percent (stock returns).

The competition between the dividend growth model and the average stock return is more interesting for 1951 to 2000. The dividend growth estimate of the 1951 to 2000 expected return, 4.74 percent, is less than half the average return, 9.62 percent. The dividend growth estimate of the equity premium, 2.55 percent, is 34 percent of the estimate from returns, 7.43 percent. The 1951 to 2000 estimates of the expected stock return and the equity premium from the earnings growth model, 6.51 percent and 4.32 percent, are higher than for the dividend growth model. But they are well below the estimates from the average return, 9.62 percent and 7.43 percent.

*B. Evaluating the Expected Return Estimates for 1951 to 2000*

We judge that the estimates of the expected stock return for 1951 to 2000 from fundamentals are closer to the true expected value, for three reasons.

(a) The expected return estimates from the dividend and earnings growth models are more precise than the average return. The standard error of the dividend growth estimate of the expected return for 1951 to 2000 is 0.74 percent, versus 2.43 percent for the average stock return. Since earnings growth is more volatile than dividend growth, the standard error of the expected return from the earnings growth model, 1.93 percent, is higher than the estimate from the dividend growth model, but it is smaller than the 2.43 percent standard error of the average stock return. Claus and Thomas (2001) also argue that expected return estimates from fundamentals are more precise than average returns, but they provide no direct evidence.

(b) Table I shows Sharpe ratios for the three equity premium estimates. Only the average premium in the numerator of the Sharpe ratio differs for the three estimates. The denominator for all three is the standard deviation of the annual stock return. The Sharpe ratio for the dividend growth estimate of the equity premium for 1872 to 1950, 0.22, is close to that produced by the average stock return, 0.23. More interesting, the Sharpe ratio for the equity premium for 1951 to 2000 from the dividend growth model, 0.15, is lower than but similar to that for 1872 to 1950. The Sharpe ratio for the 1951 to 2000 equity premium from the earnings growth model, 0.25, is somewhat higher than the dividend growth estimate, 0.15, but it is similar to the estimates for 1872 to 1950 from the dividend growth model, 0.22, and the average return, 0.23.

In asset pricing theory, the Sharpe ratio is related to aggregate risk aversion. The Sharpe ratios for the 1872 to 1950 and 1951 to 2000 equity premiums from the dividend growth model and the earnings growth model suggest that aggregate risk aversion is roughly similar in the two periods. In contrast, though return volatility falls a bit, the equity premium estimate from the average stock return increases from 4.40 percent for 1872 to 1950 to 7.43 percent for 1951 to 2000, and its Sharpe ratio about doubles, from 0.23 to 0.44. It seems implausible that risk aversion increases so much from the earlier to the later period.

(c) Most important, the behavior of other fundamentals favors the dividend and earnings growth models. The average ratio of the book value of equity to the market value of equity for 1951 to 2000 is 0.66, the book-to-market ratio  $B_t/P_t$  is never greater than 1.12, and it is greater than 1.0 for only 6 years of the 50-year period. Since, on average, the market value of equity is substantially higher than its book value, it seems safe to conclude that, on average, the expected return on investment exceeds the cost of capital.

Suppose investment at time  $t - 1$  generates a stream of equity earnings for  $t, t + 1, \dots, t + N$  with a constant expected value. The average income return on book equity,  $A(Y_t/B_{t-1})$ , is then an estimate of the expected return on equity's share of assets. It is an unbiased estimate when  $N$  is infinite and

it is upward biased when  $N$  is finite. In either case, if the expected return on investment exceeds the cost of capital, we should find that (except for sampling error) the average income return on book equity is greater than estimates of the cost of equity capital (the expected stock return):

$$A(Y_t/B_{t-1}) > E(R). \quad (4)$$

Table I shows that (4) is confirmed when we use the dividend and earnings growth models to estimate the expected real stock return for 1951 to 2000. The estimates of  $E(R)$ , 4.74 percent (dividend growth model) and 6.51 percent (earnings growth model), are below 7.60 percent, the average real income return on book equity,  $A(Y_t/B_{t-1})$ . In contrast, the average real stock return for 1951 to 2000, 9.62 percent, exceeds the average income return by more than 2 percent. An expected stock return that exceeds the expected income return on book equity implies that the typical corporate investment has a negative net present value. This is difficult to reconcile with an average book-to-market ratio substantially less than one.

To what extent are our results new? Using analyst forecasts of expected cash flows and a more complicated valuation model, Claus and Thomas (2001) produce estimates of the expected stock return for 1985 to 1998 far below the average return. Like us, they argue that the estimates from fundamentals are closer to the true expected return. We buttress this conclusion with new results on three fronts. (a) The long-term perspective provided by the evidence that, for much of the 1872 to 2000 period, average returns and fundamentals produce similar estimates of the expected return. (b) Direct evidence that the expected return estimates for 1951 to 2000 from fundamentals are more precise. (c) Sharpe ratios and evidence on how the alternative expected return estimates line up with the income return on investment. These new results provide support for the expected return estimates from fundamentals, and for the more specific inference that the average stock return for 1951 to 2000 is above the expected return.

## II. Unexpected Capital Gains

Valuation theory suggests three potential explanations for why the 1951 to 2000 average stock return is larger than the expected return. (a) Dividend and earnings growth for 1951 to 2000 is unexpectedly high. (b) The expected (post-2000) growth rates of dividends and earnings are unexpectedly high. (c) The expected stock return (the equity discount rate) is unexpectedly low at the end of the sample period.

### *A. Is Dividend Growth for 1951 to 2000 Unexpectedly High?*

If the prosperity of the United States over the last 50 years was not fully anticipated, dividend and earnings growth for 1951 to 2000 exceed 1950 expectations. Such unexpected in-sample growth produces unexpected cap-

ital gains. But it does not explain why the average return for 1951 to 2000 (the average dividend yield plus the average rate of capital gain) is so much higher than the expected return estimates from fundamentals (the average dividend yield plus the average growth rate of dividends or earnings). To see the point, note that unexpected in-sample dividend and earnings growth do not affect either the 1950 or the 2000 dividend–price and earnings–price ratios. (The 2000 ratios depend on post-2000 expected returns and growth rates.) Suppose  $D_t/P_t$  and  $E_t/P_t$  were the same in 1950 and 2000. Then the total percent growth in dividends and earnings during the period would be the same as the percent growth in the stock price. And (1), (2), and (3) would provide similar estimates of the expected stock return.

It is worth dwelling on this point. There is probably survivor bias in the U.S. average stock return for 1872 to 1950, as well as for 1951 to 2000. During the 1872 to 2000 period, it was not a foregone conclusion that the U.S. equity market would survive several financial panics, the Great Depression, two world wars, and the cold war. The average return for a market that survives many potentially cataclysmic challenges is likely to be higher than the expected return (Brown, Goetzmann, and Ross (1995)). But if the positive bias shows up only as higher than expected dividend and earnings growth during the sample period, there is similar survivor bias in the expected return estimates from fundamentals—a problem we do not solve. Our more limited goal is to explain why the average stock return for 1951 to 2000 is so high relative to the expected return estimates from the dividend and earnings growth models.

Since unexpected growth for 1951 to 2000 has a similar effect on the three expected return estimates, the task of explaining why the estimates are so different falls to the end-of-sample values of future expected returns and expected dividend and earnings growth. We approach the problem by first looking for evidence that expected dividend or earnings growth is high at the end of the sample period. We find none. We then argue that the large spread of capital gains over dividend and earnings growth for 1951 to 2000, or equivalently, the low end-of-sample dividend–price and earnings–price ratios, are due to an unexpected decline in expected stock returns to unusually low end-of-sample values.

#### *B. Are Post-2000 Expected Dividend and Earnings Growth Rates Unusually High?*

The behavior of dividends and earnings provides little evidence that rationally assessed (i.e., true) long-term expected growth is high at the end of the sample period. If anything, the growth rate of real dividends declines during the 1951 to 2000 period (Table II). The average growth rate for the first two decades, 1.60 percent, is higher than the average growth rates for the last three, 0.68 percent. The regressions in Table III are more formal evidence on the best forecast of post-2000 real dividend growth rates. Re-

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Table II  
Means of Simple Real Equity Premium and Related Statistics for  
the S&P Portfolio for 10-year Periods

The inflation rate for year  $t$  is  $Inf_t = L_t/L_{t-1} - 1$ , where  $L_t$  is the price level at the end of year  $t$ . The real return for year  $t$  on six-month (three-month for the year 2000) commercial paper (rolled over at midyear) is  $F_t$ . The nominal price of the S&P index at the end of year  $t$  is  $p_t$ . Nominal S&P dividends and earnings for year  $t$  are  $d_t$  and  $y_t$ . Real rates of growth of dividends, earnings, and the stock price are  $GD_t = (d_t/d_{t-1})*(L_{t-1}/L_t) - 1$ ,  $GY_t = (y_t/y_{t-1})*(L_{t-1}/L_t) - 1$ , and  $GP_t = (p_t/p_{t-1})*(L_{t-1}/L_t) - 1$ . The real dividend yield is  $D_t/P_{t-1} = (d_t/p_{t-1})*(L_{t-1}/L_t)$ . The dividend growth estimate of the real S&P return for  $t$  is  $RD_t = D_t/P_{t-1} + GD_t$ , the earnings growth estimate is  $RY_t = D_t/P_{t-1} + GY_t$ , and  $R_t$  is the realized real S&P return. The dividend and earnings growth estimates of the real equity premium for year  $t$  are  $RXD_t = RD_t - F_t$  and  $RXY_t = RY_t - F_t$ , and  $RX_t = R_t - F_t$  is the real equity premium from the realized real return. All variables are expressed as percents, that is, they are multiplied by 100.

	$Inf_t$	$F_t$	$D_t/P_{t-1}$	$GD_t$	$GY_t$	$GP_t$	$RD_t$	$RY_t$	$R_t$	$RXD_t$	$RXY_t$	$RX_t$
1872-1880	-2.77	9.86	6.29	4.62	NA	7.13	10.91	NA	13.42	1.06	NA	3.56
1881-1890	-1.72	7.23	5.04	0.69	NA	0.04	5.73	NA	5.08	-1.51	NA	-2.15
1891-1900	0.18	5.08	4.40	4.49	NA	4.75	8.89	NA	9.15	3.81	NA	4.08
1901-1910	1.95	3.18	4.45	3.25	NA	2.33	7.70	NA	6.78	4.52	NA	3.60
1911-1920	6.82	0.82	5.70	-3.43	NA	-6.52	2.27	NA	-0.83	1.45	NA	-1.64
1921-1930	-1.70	7.41	5.72	9.07	NA	11.83	14.78	NA	17.54	7.37	NA	10.13
1931-1940	-1.23	2.80	5.31	0.36	NA	2.21	5.67	NA	7.52	2.87	NA	4.72
1941-1950	6.04	-4.57	5.90	3.02	NA	2.33	8.91	NA	8.22	13.48	NA	12.79
1951-1960	1.79	1.05	4.68	1.22	0.61	10.64	5.90	5.30	15.32	4.85	4.24	14.27
1961-1970	2.94	2.27	3.21	1.98	2.07	2.69	5.19	5.27	5.90	2.92	3.01	3.63
1971-1980	8.11	-0.30	4.04	-0.86	3.47	-1.92	3.18	7.50	2.12	3.48	7.80	2.42
1981-1990	4.51	5.32	4.19	2.32	0.37	5.40	6.51	4.56	9.59	1.19	-0.75	4.28
1991-2000	2.68	2.61	2.36	0.58	7.58	12.80	2.94	9.94	15.16	0.32	7.32	12.54

Table III

**Regressions to Forecast Real Dividend and Earnings Growth Rates,  $GD_t$  and  $GY_t$** 

The price level at the end of year  $t$  is  $L_t$ . The nominal values of book equity and price for the S&P index at the end of year  $t$  are  $b_t$  and  $p_t$ . Nominal S&P dividends and earnings for year  $t$  are  $d_t$  and  $y_t$ . The real dividend and earnings growth rates for year  $t$  are  $GD_t = (d_t/d_{t-1}) * (L_{t-1}/L_t) - 1$  and  $GY_t = (y_t/y_{t-1}) * (L_{t-1}/L_t) - 1$ , and  $R_t$  is the realized real return on the S&P portfolio for year  $t$ . The regression intercept is  $Int$ , and  $t$ -Stat is the regression coefficient ( $Coef$ ) divided by its standard error. The regression  $R^2$  is adjusted for degrees of freedom. Except for the dividend payout ratio,  $d_t/y_t$ , all variables are expressed as percents, that is, they are multiplied by 100.

Panel A: One Year: The Regressions Forecast Real Dividend Growth, $GD_t$ , with Variables Known at $t - 1$										
	$Int$	$d_{t-1}/y_{t-1}$	$d_{t-1}/p_{t-1}$	$GD_{t-1}$	$GD_{t-2}$	$GD_{t-3}$	$R_{t-1}$	$R_{t-2}$	$R_{t-3}$	$R^2$
1875–1950, $N = 76$ years										
<i>Coef</i>	29.56	-23.12	-2.63	-0.12	-0.07	-0.03	0.22	0.13	0.09	0.38
<i>t-Stat</i>	3.22	-3.17	-1.77	-1.08	-0.64	-0.29	2.24	1.37	1.01	
1951–2000, $N = 50$ years										
<i>Coef</i>	-2.16	2.97	0.11	-0.07	-0.20	-0.06	0.11	0.07	0.01	0.01
<i>t-Stat</i>	-0.40	0.33	0.16	-0.45	-1.57	-0.45	2.17	1.33	0.22	

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Panel B: Two Years: The Regressions Forecast Real Dividend Growth, $GD_t$ , with Variables Known at $t - 2$											
	$Int$	$d_{t-2}/y_{t-2}$	$d_{t-2}/p_{t-2}$	$GD_{t-2}$	$GD_{t-3}$	$R_{t-2}$	$R_{t-3}$	$R^2$			
1875–1950, $N = 76$ years											
$Coef$	6.61	-11.60	0.31	-0.26	0.05	0.24	0.11	0.07			
$t\text{-}Stat$	0.64	-1.28	0.18	-2.02	0.39	2.03	1.00				
1951–2000, $N = 50$ years											
$Coef$	-4.11	7.62	0.32	-0.14	-0.03	0.05	-0.01	-0.05			
$t\text{-}Stat$	-0.73	0.81	0.46	-1.13	-0.28	0.99	-0.16				
Panel C: One Year: The Regressions Forecast Real Earnings Growth, $GY_t$ , with Variables Known at $t - 1$											
	$Int$	$Y_{t-1}/B_{t-2}$	$d_{t-1}/y_{t-1}$	$y_{t-1}/p_{t-1}$	$GY_{t-1}$	$GY_{t-2}$	$GY_{t-3}$	$R_{t-1}$	$R_{t-2}$	$R_{t-3}$	$R^2$
1951–2000, $N = 50$ years											
$Coef$	5.48	0.11	13.06	-1.36	0.21	-0.13	-0.31	0.28	-0.25	0.03	0.40
$t\text{-}Stat$	0.33	0.11	0.52	-1.91	1.17	-0.89	-2.64	2.39	-2.18	0.26	
Panel D: Two Years: The Regressions Forecast Real Earnings Growth, $GY_t$ , with Variables Known at $t - 2$											
	$Int$	$Y_{t-2}/B_{t-3}$	$d_{t-2}/y_{t-2}$	$y_{t-2}/p_{t-2}$	$GY_{t-2}$	$GY_{t-3}$	$R_{t-2}$	$R_{t-3}$	$R^2$		
1951–2000, $N = 50$ years											
$Coef$	-7.60	0.46	2.05	-0.74	-0.16	-0.39	-0.31	-0.12	0.23		
$t\text{-}Stat$	-0.43	1.66	0.76	-1.02	-0.92	-2.54	-2.59	-0.97			

gressions are shown for forecasts one year ahead (the explanatory variables for year  $t$  dividend growth are known at the end of year  $t - 1$ ) and two years ahead (the explanatory variables are known at the end of year  $t - 2$ ).

The regression for 1875 to 1950 suggests strong forecast power one year ahead. The slopes on the lagged payout ratio, the dividend-price ratio, and the stock return are close to or more than two standard errors from zero, and the regression captures 38 percent of the variance of dividend growth. Even in the 1875 to 1950 period, however, power to forecast dividend growth does not extend much beyond a year. When dividend growth for year  $t$  is explained with variables known at the end of year  $t - 2$ , the regression  $R^2$  falls from 0.38 to 0.07. Without showing the details, we can report that extending the forecast horizon from two to three years causes all hint of forecast power to disappear. Thus, for 1875 to 1950, the best forecast of dividend growth more than a year or two ahead is the historical average growth rate.

We are interested in post-2000 expected dividend growth, and even the short-term forecast power of the dividend regressions for 1872 to 1950 evaporates in the 1951 to 2000 period. The lagged stock return has some information ( $t = 2.17$ ) about dividend growth one year ahead. But the 1951 to 2000 regression picks up only one percent of the variance of dividend growth. And forecast power does not improve for longer forecast horizons. Our evidence that dividend growth is essentially unpredictable during the last 50 years confirms the results in Campbell (1991), Cochrane (1991, 1994), and Campbell and Shiller (1998). If dividend growth is unpredictable, the historical average growth rate is the best forecast of future growth.

Long-term expected earnings growth also is not unusually high in 2000. There is no clear trend in real earnings growth during the 1951 to 2000 period. The most recent decade, 1991 to 2000, produces the highest average growth rate, 7.58 percent per year (Table II). But earnings growth is volatile. The standard errors of 10-year average growth rates vary around 5 percent. It is thus not surprising that 1981 to 1990, the decade immediately preceding 1991 to 2000, produces the lowest average real earnings growth rate, 0.37 percent per year.

The regressions in Table III are formal evidence on the predictability of earnings growth during the 1951 to 2000 period. There is some predictability of near-term growth, but it is largely due to transitory variation in earnings that is irrelevant for forecasting long-term earnings. In the 1951 to 2000 regression to forecast earnings growth one year ahead, the slope on the first lag of the stock return is positive (0.28,  $t = 2.39$ ), but the slope on the second lag is negative ( $-0.25$ ,  $t = -2.18$ ) and about the same magnitude. Thus, the prediction of next year's earnings growth from this year's return is reversed the following year. In the one-year forecast regression for 1951 to 2000, the only variable other than lagged returns with power to forecast earnings growth ( $t = -2.64$ ) is the third lag of earnings growth. But the slope is negative, so it predicts that the strong earnings growth of recent years is soon to be reversed.

In the 1951 to 2000 regression to forecast earnings one year ahead, there is a hint ( $t = -1.91$ ) that the low earnings–price ratio at the end of the period implies higher than average expected growth one year ahead. But the effect peters out quickly; the slope on the lagged earnings–price ratio in the regression to forecast earnings growth two years ahead is  $-1.02$  standard errors from zero. The only variables with forecast power two years ahead are the second lag of the stock return and the third lag of earnings growth. But the slopes on these variables are negative, so again the 2000 prediction is that the strong earnings growth of recent years is soon to be reversed. And again, regressions (not shown) confirm that forecast power for 1951 to 2000 does not extend beyond two years. Thus, beyond two years, the best forecast of earnings growth is the historical average growth rate.

In sum, the behavior of dividends for 1951 to 2000 suggests that future growth is largely unpredictable, so the historical mean growth rate is a near optimal forecast of future growth. Earnings growth for 1951 to 2000 is somewhat predictable one and two years ahead, but the end-of-sample message is that the recent high growth rates are likely to revert quickly to the historical mean. It is also worth noting that the market survivor bias argument of Brown, Goetzmann, and Ross (1995) suggests that past average growth rates are, if anything, upward biased estimates of future growth. In short, we find no evidence to support a forecast of strong future dividend or earnings growth at the end of our sample period.

### *C. Do Expected Stock Returns Fall during the 1951 to 2000 Period?*

The S&P dividend–price ratio,  $D_t/P_t$ , falls from 7.18 percent at the end of 1950 to a historically low 1.22 percent at the end of 2000 (Figure 1). The growth in the stock price,  $P_{2000}/P_{1950}$ , is thus 5.89 times the growth in dividends,  $D_{2000}/D_{1950}$ . The S&P earnings–price ratio,  $Y_t/P_t$ , falls from 13.39 percent at the end of 1950 to 3.46 percent at the end of 2000, so the percent capital gain of the last 50 years is 3.87 times the percent growth in earnings. (Interestingly, almost all of the excess capital gain occurs in the last 20 years; Figure 1 shows that the 1979 earnings–price ratio, 13.40 percent, is nearly identical to the 13.39 percent value of 1950.)

All valuation models say that  $D_t/P_t$  and  $E_t/P_t$  are driven by expected future returns (discount rates) and expectations about future dividend and earnings growth. Our evidence suggests that rational forecasts of long-term dividend and earnings growth rates are not unusually high in 2000. We conclude that the large spread of capital gains for 1951 to 2000 over dividend and earnings growth is largely due to a decline in the expected stock return.

Some of the decline in  $D_t/P_t$  and  $E_t/P_t$  during 1951 to 2000 is probably anticipated in 1950. The dividend–price ratio for 1950, 7.18 percent, is high (Figure 1). The average for 1872 to 2000 is 4.64 percent. If  $D_t/P_t$  is mean-reverting, the expectation in 1950 of the yield in 2000 is close to the unconditional mean, say 4.64 percent. The actual dividend–price ratio for 2000 is

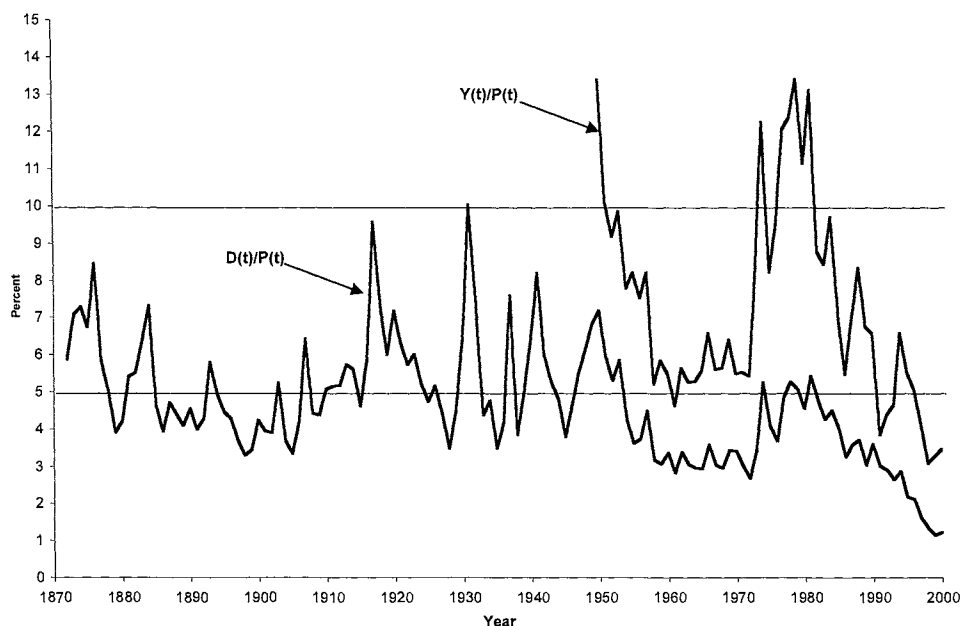


Figure 1. Dividend-price and earnings-price ratios.

1.22 percent. The 2000 stock price is thus  $4.64/1.22 = 3.80$  times what it would be if the dividend yield for 2000 hit the historical mean. Roughly speaking, this unexpected capital gain adds about 2.67 percent to the compound annual return for 1951 to 2000.

Similarly, part of the large difference between the 1951 to 2000 capital gain and the growth in earnings is probably anticipated in 1950. The 13.39 percent value of  $Y_t/P_t$  in 1950 is high relative to the mean for 1951 to 2000, 7.14 percent. If the earnings-price ratio is stationary, the expectation in 1950 of  $Y_t/P_t$  for 2000 is close to the unconditional mean, say 7.14 percent. The actual  $Y_t/P_t$  for 2000 is 3.46 percent. Thus, the 2000 stock price is  $7.14/3.46 = 2.06$  times what it would be if the ratio for 2000 hit the 7.14 percent average value for 1951 to 2000. Roughly speaking, this estimate of the unexpected capital gain adds about 1.45 percent to the compound annual return for the 50-year period.

In short, the percent capital gain for 1951 to 2000 is several times the growth of dividends or earnings. The result is historically low dividend-price and earnings-price ratios at the end of the period. Since the ratios are high in 1950, some of their subsequent decline is probably expected, but much of it is unexpected. Given the evidence that rational forecasts of long-term growth rates of dividends and earnings are not high in 2000, we conclude that the unexpected capital gains for 1951 to 2000 are largely due to a decline in the discount rate. In other words, the low end-of-sample price ratios imply low (rationally assessed, or true) expected future returns.

Like us, Campbell (1991), Cochrane (1994), and Campbell and Shiller (1998) find that, for recent periods, dividend and earnings growth are largely unpredictable, so variation in dividend–price and earnings–price ratios is largely due to the expected stock return. The samples in Campbell (1991) and Cochrane (1994) end in 1988 (before the strong subsequent returns that produce sharp declines in the price ratios), and they focus on explaining, in general terms, how variation in  $D_t/P_t$  splits between variation in the expected stock return and expected dividend growth. Campbell and Shiller (1998) focus on the low expected future returns implied by the low price ratios of recent years.

In contrast, we are more interested in what the decline in the price ratios says about past returns, specifically, that the average return for 1951 to 2000 is above the expected return. And this inference does not rest solely on the information in price ratios. We buttress it with two types of novel evidence. (a) The perspective from our long sample period that, although the average stock return for 1951 to 2000 is much higher than expected return estimates from fundamentals, the two approaches produce similar estimates for 1872 to 1950. (b) Evidence from Sharpe ratios, the book-to-market ratio, and the income return on investment, which also suggests that the average return for 1951 to 2000 is above the expected value.

### **III. Estimating the Expected Stock Return: Issues**

There are two open questions about our estimates of the expected stock return. (a) In recent years the propensity of firms to pay dividends declines and stock repurchases surge. How do these changes in dividend policy affect our estimates of the expected return? (b) Under rather general conditions, the dividend and earnings growth models (2) and (3) provide estimates of the expected stock return. Are the estimates biased and does the bias depend on the return horizon? This section addresses these issues.

#### *A. Repurchases and the Declining Incidence of Dividend Payers*

Share repurchases surge after 1983 (Bagwell and Shoven (1989) and Dunsby (1995)), and, after 1978, the fraction of firms that do not pay dividends steadily increases (Fama and French (2001)). More generally, dividends are a policy variable, and changes in policy can raise problems for estimates of the expected stock return from the dividend growth model. There is no problem in the long-term, as long as dividend policies stabilize and the dividend–price ratio resumes its mean-reversion, though perhaps to a new mean. (An Appendix, available on request, provides an example involving repurchases.) But there can be problems during transition periods. For example, if the fraction of firms that do not pay dividends steadily increases, the market dividend–price ratio is probably nonstationary; it is likely to decline over time, and the dividend growth model is likely to underestimate the expected stock return.

Fortunately, the earnings growth model is not subject to the problems posed by drift in dividend policy. The earnings growth model provides an estimate of the expected stock return when the earnings–price ratio is stationary. And as discussed earlier, the model provides an estimate of the average expected return during the sample period when there are permanent shifts in the expected value of  $Y_t/P_t$ , as long as the ratio mean-reverts within regimes.

The earnings growth model is not, however, clearly superior to the dividend growth model. The standard deviation of annual earnings growth rates for 1951 to 2000 (13.79 percent, versus 5.09 percent for dividends) is similar to that of capital gains (16.77 percent), so much of the precision advantage of using fundamentals to estimate the expected stock return is lost. We see next that the dividend growth model has an advantage over the earnings growth model and the average stock return if the goal is to estimate the long-term expected growth of wealth.

### *B. The Investment Horizon*

The return concept in discrete time asset pricing models is a one-period simple return, and our empirical work focuses on the one-year return. But many, if not most, investors are concerned with long-term returns, that is, terminal wealth over a long holding period. Do the advantages and disadvantages of different expected return estimates depend on the return horizon? This section addresses this question.

#### *B.1. The Expected Annual Simple Return*

There is downward bias in the estimates of the expected annual simple return from the dividend and earnings growth models—the result of a variance effect. The expected value of the dividend growth estimate of the expected return, for example, is the expected value of the dividend yield plus the expected value of the annual simple dividend growth rate. The expected annual simple return is the expected value of the dividend yield plus the expected annual simple rate of capital gain. If the dividend–price ratio is stationary, the compound rate of capital gain converges to the compound dividend growth rate as the sample period increases. But because the dividend growth rate is less volatile than the rate of capital gain, the expected simple dividend growth rate is less than the expected simple rate of capital gain.

The standard deviation of the annual simple rate of capital gain for 1951 to 2000 is 3.29 times the standard deviation of the annual dividend growth rate (Table I). The resulting downward bias of the average dividend growth rate as an estimate of the expected annual simple rate of capital gain is roughly 1.28 percent per year (half the difference between the variances of the two growth rates). Corrected for this bias, the dividend growth estimate of the equity premium in the simple returns of 1951 to 2000 rises from 2.55 to 3.83 percent (Table IV), which is still far below the estimate from the average return, 7.43 percent. Since the earnings growth rate and the annual rate of capital gain have similar standard deviations for 1951 to 2000,

**Table IV**  
**Estimates of the Real Equity Premium in Simple**  
**Annual and Long-term Returns: 1951 to 2000**

The inflation rate for year  $t$  is  $Inf_t = L_t/L_{t-1}$ , where  $L_t$  is the price level at the end of year  $t$ . The real return for year  $t$  on six-month (three-month for the year 2000) commercial paper (rolled over at midyear) is  $F_t$ . The nominal value of the S&P index at the end of year  $t$  is  $p_t$ . Nominal S&P dividends and earnings for year  $t$  are  $d_t$  and  $y_t$ . Real rates of growth of dividends, earnings, and the stock price are  $GD_t = (d_t/d_{t-1})*(L_{t-1}/L_t) - 1$ ,  $GY_t = (y_t/y_{t-1})*(L_{t-1}/L_t) - 1$ , and  $GP_t = (p_t/p_{t-1})*(L_{t-1}/L_t) - 1$ . The real dividend yield is  $D_t/P_{t-1} = (d_t/p_{t-1})*(L_{t-1}/L_t)$ . The dividend growth estimate of the real S&P return for  $t$  is  $RD_t = D_t/P_{t-1} + GD_t$ , the earnings growth estimate is  $RY_t = D_t/P_{t-1} + GY_t$ , and  $R_t$  is the realized real S&P return. The dividend and earnings growth estimates of the real equity premium for year  $t$  are  $RXD_t = RD_t - F_t$  and  $RXY_t = RY_t - F_t$ , and  $RX_t = R_t - F_t$  is the real equity premium from the realized real return. The average values of the equity premium estimates are  $A(RXD_t)$ ,  $A(RXY_t)$ , and  $A(RX_t)$ . The first column of the table shows unadjusted estimates of the annual simple equity premium. The second column shows bias-adjusted estimates of the annual premium. The bias adjustment is one-half the difference between the variance of the annual rate of capital gain and the variance of either the dividend growth rate or the earnings growth rate. The third column shows bias-adjusted estimates of the expected equity premium relevant if one is interested in the long-term growth rate of wealth. The bias adjustment is one-half the difference between the variance of the annual dividend growth rate and the variance of either the growth rate of earnings or the rate of capital gain. The equity premiums are expressed as percents.

	Unadjusted	Bias-adjusted	
		Annual	Long-term
$A(RXD_t)$	2.55	3.83	2.55
$A(RXY_t)$	4.32	4.78	3.50
$A(RX_t)$	7.43	7.43	6.16

13.79 percent and 16.77 percent (Table I), the bias of the earnings growth estimate of the expected return is smaller (0.46 percent). Corrected for bias, the estimate of the equity premium for 1951 to 2000 from the earnings growth model rises from 4.32 to 4.78 percent (Table IV), which again is far below the 7.43 percent estimate from the average return.

### *B.2. Long-term Expected Wealth*

The (unadjusted) estimate of the expected annual simple return from the dividend growth model is probably the best choice if we are concerned with the long-term expected wealth generated by the market portfolio. The annual dividend growth rates of 1951 to 2000 are essentially unpredictable. If the dividend growth rate is serially uncorrelated, the expected value of the compounded dividend growth rate is the compounded expected simple growth rate:

$$E \left[ \prod_{t=1}^T (1 + GD_t) \right] = [1 + E(GD)]^T. \quad (5)$$

And if the dividend–price ratio is stationary, for long horizons the expected compounded dividend growth rate is the expected compounded rate of capital gain:

$$E \left[ \prod_{t=1}^T (1 + GD_t) \right] = E \left[ \prod_{t=1}^T (1 + GP_t) \right]. \quad (6)$$

Thus, when the horizon  $T$  is long, compounding the true expected annual simple return from the dividend growth model produces an unbiased estimate of the expected long-term return:

$$[1 + E(RD)]^T = E \left[ \prod_{t=1}^T (1 + R_t) \right]. \quad (7)$$

In contrast, if the dividend growth rate is unpredictable and the dividend–price ratio is stationary, part of the higher volatility of annual rates of capital gain is transitory, the result of a mean-reverting expected annual return (Cochrane (1994)). Thus, compounding even the true unconditional expected annual simple return,  $E(R)$ , yields an upward biased measure of the expected compounded return:

$$[1 + E(R)]^T > E \left[ \prod_{t=1}^T (1 + R_t) \right]. \quad (8)$$

There is a similar problem in using the average (simple) earnings growth rate to estimate long-term expected wealth. The regressions in Table III suggest that the predictability of earnings growth for 1951 to 2000 is due to transitory variation in earnings. As a result, annual earnings growth is 2.71 times more volatile than dividend growth (Table I). The compound growth rate of earnings for 1951 to 2000, 1.89 percent, is 2.05 times the compound dividend growth rate, 0.92 percent. But because earnings are more volatile, the average simple growth rate of earnings, 2.82 percent, is 2.69 times the average simple growth rate of dividends, 1.05 percent. As a result, the average simple growth rate of earnings produces an upward biased estimate of the compound rate of growth of long-term expected wealth.

We can correct the bias by subtracting half the difference between the variance of earnings growth and the variance of dividend growth (0.82 percent) from the average earnings growth rate. The estimate of the expected rate of capital gain provided by this adjusted average growth rate of earnings is 2.00 percent per year. Using this adjusted average growth rate of earnings, the earnings growth estimate of the expected real stock return for 1951 to 2000 falls from 6.51 to 5.69 percent. The estimate of the equity premium falls from 4.32 to 3.50 percent (Table IV), which is closer to the 2.55 percent obtained when the average dividend growth rate is used to

estimate the expected rate of capital gain. Similarly, adjusting for the effects of transitory return volatility causes the estimate of the equity premium from realized stock returns to fall from 7.43 to 6.16 percent, which is still far above the bias-adjusted estimate of the earnings growth model (3.50 percent) and the estimate from the dividend growth model (2.55 percent).

Finally, we only have estimates of the expected growth rates of dividends and earnings and the expected rate of capital gain. Compounding estimates rather than true expected values adds upward bias to measures of expected long-term wealth (Blume (1974)). The bias increases with the imprecision of the estimates. This is another reason to favor the more precise estimate of the expected stock return from the dividend growth model over the earnings growth estimate or the estimate from the average stock return.

#### IV. Conclusions

There is a burgeoning literature on the equity premium. Our main additions are on two fronts. (a) A long (1872 to 2000) perspective on the competing estimates of the unconditional expected stock return from fundamentals (the dividend and earnings growth models) and the average stock return. (b) Evidence (estimates of precision, Sharpe ratios, and the behavior of the book-to-market ratio and the income return on investment) that allows us to choose between the expected return estimates from the two approaches.

Specifically, the dividend growth model and the realized average return produce similar real equity premium estimates for 1872 to 1950, 4.17 percent and 4.40 percent. For the half-century from 1951 to 2000, however, the equity premium estimates from the dividend and earnings growth models, 2.55 percent and 4.32 percent, are far below the estimate from the average return, 7.43 percent.

We argue that the dividend and earnings growth estimates of the equity premium for 1951 to 2000 are closer to the true expected value. This conclusion is based on three results.

(a) The estimates from fundamentals, especially the estimate from the dividend growth model, are more precise; they have lower standard errors than the estimate from the average return.

(b) The appealing message from the dividend and earnings growth models is that aggregate risk aversion (as measured by the Sharpe ratio for the equity premium) is on average roughly similar for the 1872 to 1949 and 1950 to 1999 periods. In contrast, the Sharpe ratio for the equity premium from the average return just about doubles from the 1872 to 1950 period to the 1951 to 2000 period.

(c) Most important, the average stock return for 1951 to 2000 is much greater than the average income return on book equity. Taken at face value, this says that investment during the period is on average unprofitable (its expected return is less than the cost of capital). In contrast, the lower estimates of the expected stock return from the dividend and earnings growth models are less than the income return on investment, so the message is

that investment is on average profitable. This is more consistent with book-to-market ratios that are rather consistently less than one during the period.

If the average stock return for 1951 to 2000 exceeds the expected return, stocks experience unexpected capital gains. What is the source of the gains? Growth rates of dividends and earnings are largely unpredictable, so there is no basis for extrapolating unusually high long-term future growth. This leaves a decline in the expected stock return as the prime source of the unexpected capital gain. In other words, the high return for 1951 to 2000 seems to be the result of low expected future returns.

Many papers suggest that the decline in the expected stock return is in part permanent, the result of (a) wider equity market participation by individuals and institutions, and (b) lower costs of obtaining diversified equity portfolios from mutual funds (Diamond (1999), Heaton and Lucas (1999), and Siegel (1999)). But there is also evidence that the expected stock return is slowly mean reverting (Fama and French (1989) and Cochrane (1994)). Moreover, there are two schools of thought on how to explain the variation in expected returns. Some attribute it to rational variation in response to macroeconomic factors (Fama and French (1989), Blanchard (1993), and Cochrane (1994)), while others judge that irrational swings in investor sentiment are the prime moving force (e.g., Shiller (1989)). Whatever the story for variation in the expected return, and whether it is temporary or partly permanent, the message from the low end-of-sample dividend-price and earnings-price ratios is that we face a period of low (true) expected returns.

Our main concern, however, is the unconditional expected stock return, not the end-of-sample conditional expected value. Here there are some nuances. If we are interested in the unconditional expected annual simple return, the estimates for 1951 to 2000 from fundamentals are downward biased. The bias is rather large when the average growth rate of dividends is used to estimate the expected rate of capital gain, but it is small for the average growth rate of earnings. On the other hand, if we are interested in the long-term expected growth of wealth, the dividend growth model is probably best, and the average stock return and the earnings growth estimate of the expected return are upward biased. But our bottom line inference does not depend on whether one is interested in the expected annual simple return or long-term expected wealth. In either case, the bias-adjusted expected return estimates for 1951 to 2000 from fundamentals are a lot (more than 2.6 percent per year) lower than bias-adjusted estimates from realized returns. (See Table IV.) Based on this and other evidence, our main message is that the unconditional expected equity premium of the last 50 years is probably far below the realized premium.

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